(NASA-TM-85521) ROTARY WING AIRCRAFT AND TECHNICAL PUBLICATIONS OF NASA, 1970 - 1982 (National Aeronautics and Space Administration) 289 p HC A13 CSCL 05B

N84-18102

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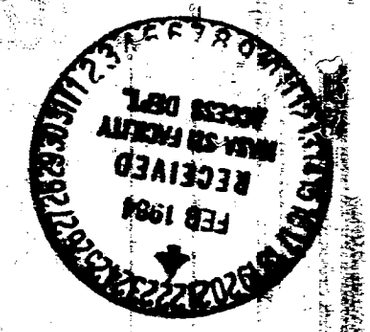
ROTARY WING AIRCRAFT SCIENTIFIC AND TECHNICAL PUBLICATIONS OF NASA BETWEEN 1970 AND 1982



Compiled by:

John D. Hiemstra
for the Rotorcraft Technology Office
of the National Aeronautics and
Space Administration
Washington, DC

July 1982

INTRODUCTION

This report is a bibliography of NASA documents published between 1970 and 1982 which pertain to rotary wing aircraft. The information was retrieved from the NASA RECON data base. While it is not an entirely complete listing most primary documents are cited. The entries are arranged in descending order by publication date except the NASA supported documents which are arranged in descending order by accession date.

933
citations

ROTARY WING AIRCRAFT SCIENTIFIC AND TECHNICAL PUBLICATIONS OF NASA BETWEEN 1970 AND 1982

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INTRODUCTION

This report is a bibliography of NASA documents published between 1970 and 1982 which pertain to rotary wing aircraft. The information was retrieved from the NASA RECON data base. While it is not an entirely complete listing most primary documents are cited. The entries are arranged in descending order by publication date except the NASA supported documents which are arranged in descending order by accession date.

REPORT SERIES DEFINITIONS

NASA CP - Conference Proceeding

NASA CR - Contract Report

NASA SP - Special Publication

NASA TM - Technical Memorandum

NASA TM X - Technical Memorandum

NASA TN D - Technical Note

NASA TP - Technical Paper

NASA TR R - Technical Report

NASA TT F - Technical Translation

AD - Defense Technical Information Center or National Technical Information Center

AGARD - NATO

AHS - American Helicopter Society

AIAA - American Institute of Astronautics and Aeronautics

ASME - American Society of Mechanical Engineers

SAE - Society of Automotive Engineers

ACCESSION SERIES DEFINITIONS

All documents entered in the NASA Recon computerized library system are assigned a unique identification number. The first two numerals of this accession number identify the year that the item entered the system. The following letter denotes the particular accession series.

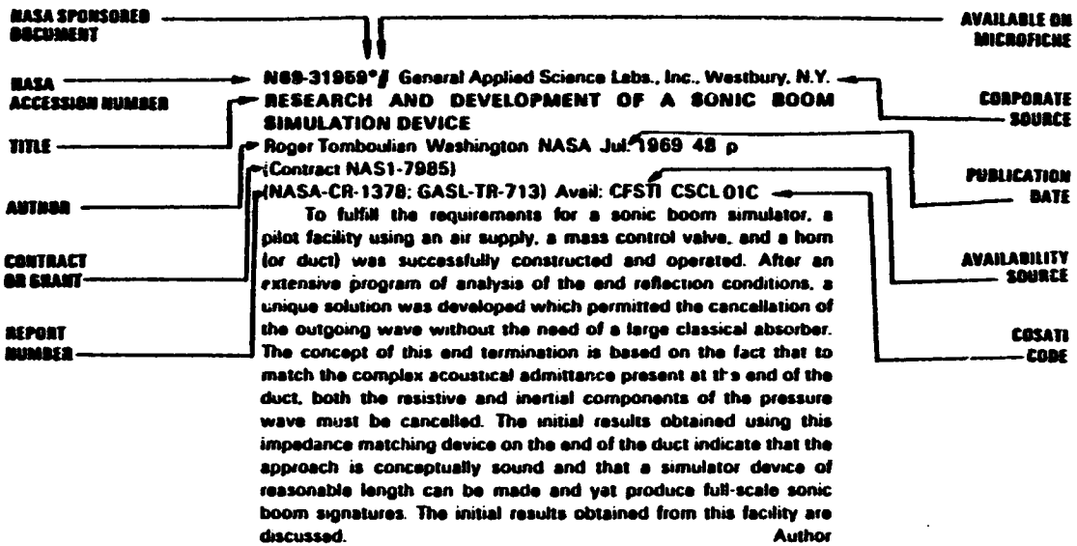
A. International Aerospace Abstracts (IAA). Open literature items accessioned by the American Institute of Aeronautics and Astronautics and announced in IAA.

N. Scientific and Technical Aerospace Reports (STAR). Unclassified documents of sufficient scientific/technical significance to warrant general announcement.

V. NASA Library Books (NALNET Books). This series consists of books, monographs, congressional documents, etc., designated by the participating NASA libraries for entry into the file.

Source: NASA/Recon System User's Manual

TYPICAL CITATION AND ABSTRACT FROM STAR



Source: NASA SP-7035

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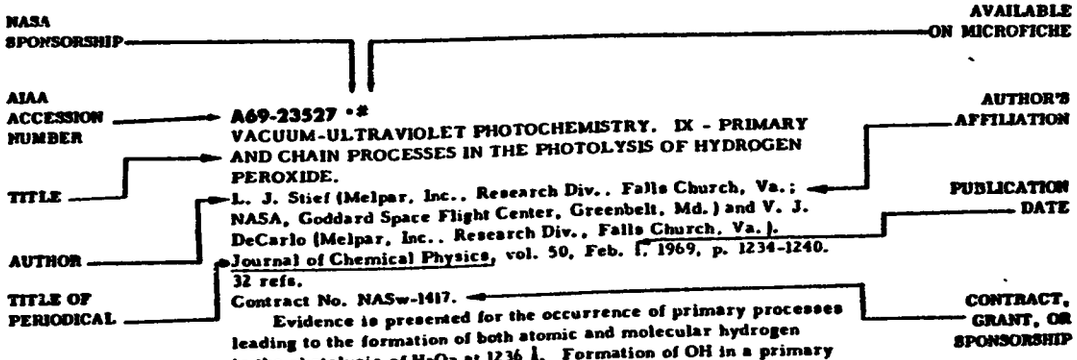

Source: NASA SP-7035

PRINT 42/2/1-170 TERMINAL=20

82N23230*# ISSUE 14 PAGE 1901 CATEGORY 3
82/04/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Applications of system identification methods to the prediction of helicopter stability, control and handling characteristics

AUTH: A/PADFIELD, G. D.; B/DUVAL, R. K. PAA: A/(RAE, Bedford, England)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS

SAP: HC A11/MF A01

In its Helicopter Handling Qualities p 233-247 (SEE N82-23208 14-03)

MAJS: /*FLIGHT CHARACTERISTICS/*HELICOPTER CONTROL/*ROTARY WING AIRCRAFT/*SYSTEMS ENGINEERING

MINS: / COMPUTER PROGRAMS/ HELICOPTER PERFORMANCE/ MATHEMATICAL MODELS

ABA: Author

ABS: A set of results on rotorcraft system identification is described. Flight measurements collected on an experimental Puma helicopter are reviewed and some notable characteristics highlighted. Following a brief review of previous work in rotorcraft system identification, the results of state estimation and model structure estimation processes applied to the Puma data are presented. The results, which were obtained using NASA developed software, are compared with theoretical predictions of roll, yaw and pitching moment derivatives for a 6 degree of freedom model structure. Anomalies are reported. The theoretical methods used are described. A framework for reduced order modelling is outlined.

82N23227*# ISSUE 14 PAGE 1900 CATEGORY 3
82/04/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter simulation technology: An Ames Research Center perspective

AUTH: A/BRAY, R. S.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS

SAP: HC A11/MF A01

In its Helicopter Handling Qualities p 199-208 (SEE N82-23208 14-03)

MAJS: /*COCKPITS/*CUES/*FLIGHT SIMULATION/*GROUND BASED CONTROL/*HELICOPTER CONTROL

MINS: / MOTION SIMULATORS/ PILOT PERFORMANCE/ SYSTEMS ENGINEERING/ VISUAL CONTROL

ABA: Author

ABS: The total experience for evidence regarding the levels of motion and visual cueing fidelity required for handling-qualities research in ground-based simulators is reviewed. Positive contributions of cockpit motion were identified, but much remains to be learned regarding the sensitivities of individual control modes to cueing attenuation. A firmer understanding of the pilot's utilization of visual and motion cues is the key to more efficient use of simulation in helicopter control-systems research.

82N23215*# ISSUE 14 PAGE 1899 CATEGORY 3
82/04/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Unified results of several analytical and experimental studies of helicopter handling qualities in visual terrain flight

AUTH: A/CHEN, R. T. N.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS

SAP: HC A11/MF A01

In its Helicopter Handling Qualities p 59-74 (SEE N82-23208 14-03)

MAJS: /*AIRCRAFT MANEUVERS/*CONTROLLABILITY/*HELICOPTER PERFORMANCE/*NAP-OF-THE-EARTH NAVIGATION/*ROTARY WINGS /*STABILITY AUGMENTATION/*VISUAL FLIGHT

MINS: / AIRCRAFT SPECIFICATIONS/ FLIGHT CHARACTERISTICS/ HELICOPTER CONTROL/ METEOROLOGICAL PARAMETERS/ TERRAIN FOLLOWING AIRCRAFT/ WEATHER

ABA: T.M.

ABS: The studies were undertaken to investigate the effects of rotor design parameters, interaxis coupling, and various levels of stability and control augmentation on the flying qualities of helicopters performing low-level, terrain-flying tasks in visual meteorological conditions. Some unified results are presented, and the validity and limitations of the flying-qualities data obtained are interpreted. Selected results, related to various design parameters, provide guidelines for the preliminary design of rotor systems and aircraft augmentation systems.

82N23208*# ISSUE 14 PAGE 1898 CATEGORY 3 RPT#: NASA-CP-2219 A-8891 NAS 1.55:2219 82/04/00 243 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter Handling Qualities

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS

SAP: HC A11/MF A01

Proceedings of the special meeting held at Moffett Field, Calif., 14-15 Apr. 1982; sponsored by the American Helicopter Society

MAJS: /*AIRCRAFT SPECIFICATIONS/*AVIONICS/*COCKPITS/* CONFERENCES/*CONTROLLABILITY/*HELICOPTER CONTROL/* MANEUVERABILITY/*NAP-OF-THE-EARTH NAVIGATION/*NIGHT FLIGHTS (AIRCRAFT)

MINS: / AIRCRAFT INSTRUMENTS/ AIRCRAFT MANEUVERS/ AIRCRAFT

RELIABILITY/ AIRCRAFT, SURVIVABILITY/ ALL-WEATHER AIR NAVIGATION/ AUTOMATIC FLIGHT CONTROL/ COMBAT/ CONTROL BOARDS/ DISPLAY DEVICES/ FLIGHT CONTROL/ HELICOPTER PERFORMANCE/ RADAR NAVIGATION/ STABILITY *UGMENTATION

ANN: Helicopters are used by the military an[illegible]ivilian communities for a variety of tasks and must be capable of operating in poor weather conditions, and at night. Accompanying extended helicopter operations is a significant increase in pilot workload and a need for better handling qualities. An overview of the status and problems in the development and specification of helicopter handling-qualities criteria is presented. Topics for future research efforts by government and industry are highlighted. For individual titles, see N82-23209 through N82-23230.

82N20188*# ISSUE 11 PAGE 1465 CATEGORY 8 RPT#: NASA-TP-1996 NAS 1.60:1996 A-8719 82/03/00 50 PAGES UNCLASSIFIED DOCUMENT

UTTL: Self-tuning regulators for multicyclic control of helicopter vibration

AUTH: A/JOHNSON, W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*CONTROLLERS/*HELICOPTERS/*SELF ADAPTIVE CONTROL SYSTEMS/*VIBRATION DAMPING

MINS: / ALGORITHMS/ DIGITAL SYSTEMS/ FEEDBACK CONTROL/ KALMAN FILTERS/ LEAST SQUARES METHOD/ ROTARY WINGS

ABA: M.G.

ABS: A class of algorithms for the multicyclic control of helicopter vibration and loads is derived and discussed. This class is characterized by a linear, quasi-static, frequency-domain model of the helicopter response to control; identification of the helicopter model by least-squared-error or Kalman filter methods; and a minimum variance or quadratic performance function controller. Previous research on such controllers is reviewed. The derivations and discussions cover the helicopter model; the identification problem, including both off-line and on-line (recursive) algorithms; the control problem, including both open-loop and closed-loop feedback; and the various regulator configurations possible within this class. Conclusions from analysis and numerical simulations of the regulators provide guidance in the design and selection of algorithms for further development, including wind tunnel and flight tests.

82N20174*# ISSUE 11 PAGE 1463 CATEGORY 5 RPT#: NASA-TM-84222 A-8848 NAS 1.15:84222 82/03/00 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Simulation of the XV-15 tilt rotor research aircraft

AUTH: A/CHURCHILL, G. B.; B/DUGAN, D. C. PAA: A/(Army Aeromechanics Lab., Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*COMPUTERIZED SIMULATION/*FLIGHT SIMULATION/*XV-15 AIRCRAFT

MINS: / ACCURACY/ AERODYNAMIC STABILITY/ AERODYNAMICS/ AIRCRAFT CONTROL/ COCKPITS/ CONTROL SIMULATION/ CONTROLLABILITY/ DEGREES OF FREEDOM/ FLIGHT SIMULATORS / MATHEMATICAL MODELS/ MOTION SIMULATORS/ PILOT TRAINING/ SIGMA COMPUTERS/ TILT ROTOR RESEARCH AIRCRAFT PROGRAM/ VERTICAL MOTION SIMULATORS/ WORKLOADS (PSYCHOPHYSIOLOGY)

ABA: R.J.F.

ABS: The effective use of simulation from issuance of the request for proposal through conduct of a flight test program for the XV-15 Tilt Rotor Research Aircraft is discussed. From program inception, simulation complemented all phases of XV-15 development. The initial simulation evaluations during the source evaluation board proceedings contributed significantly to performance and stability and control evaluations. Eight subsequent simulation periods provided major contributions in the areas of control concepts; cockpit configuration; handling qualities; pilot workload; failure effects and recovery procedures; and flight boundary problems and recovery procedures. The fidelity of the simulation also made it a valuable pilot training aid, as well as a suitable tool for military and civil mission evaluations. Simulation also provided valuable design data for refinement of automatic flight control systems. Throughout the program, fidelity was a prime issue and resulted in unique data and methods for fidelity evaluation which are presented and discussed.

82N18179*# ISSUE 9 PAGE 1175 CATEGORY 2 RPT#: NASA-TM-81345 A-8806 82/02/00 30 PAGES UNCLASSIFIED DOCUMENT

UTTL: An analytical investigation of the free-tip rotor for helicopters

AUTH: A/STROUB, R. H.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*BLADE TIPS/*FLIGHT CHARACTERISTICS/*HELICOPTER PERFORMANCE/*HELICOPTERS/*ROTARY WINGS/*WING TIPS

MINS: / AERODYNAMIC CONFIGURATIONS/ AIRSPEED/ CRUISING

FLIGHT/ MATHEMATICAL MODELS/ PITCH (INCLINATION)/ PITCHING MOMENTS/ ROTOR LIFT

ABA: Author

ABS: A rotor configuration called the free-tip rotor was analytically investigated for its potential to improve helicopter forward-flight performance characteristics. This rotor differs from a conventional rotor only in the blade tip region. In this configuration, the tip is self-adjusting in pitch with respect to the rest of the blade, in accordance with a moment balance about its pitch axis. With this self-adjusting capability, the resulting pitch motion generates a more uniform airload distribution around the azimuth. Computer math models were used to compare performance characteristics of the free tip rotor with those of a conventional rotor operation at flight speeds from 130 to 160 knots. The results of this analysis indicate that the free-tip rotor improves cruise lift-drag ratio by at least 22%.

82A17868*# ISSUE 6 PAGE 806 CATEGORY 3 RPT#: AIAA PAPER 82-0260 82/01/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Real-time simulation of helicopter IFR approaches into major terminal areas using RNAV, MLS, and CDTI

AUTH: A/TOBIAS, L.; B/LEE, H. Q.; C/PEACH, L. L.; D/WILLETT, F. M., JR.; E/OBRIEN, P. J. PAA: C/(NASA, Ames Research Center, Moffett Field, CA); E/(FAA, Technical Center, Atlantic City, NJ)

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; Federal Aviation Administration, Atlantic City, N.J.

American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, 13 p.

MAJS: /*AIR TRAFFIC CONTROL/*CONTROL SIMULATION/*HELICOPTER CONTROL/*INSTRUMENT FLIGHT RULES/*PILOT PERFORMANCE/* REAL TIME OPERATION/*SYSTEMS SIMULATION

MINS: / AIRPORT PLANNING/ APPROACH CONTROL/ AREA NAVIGATION/ COCKPITS/ DISPLAY DEVICES/ FIXED WINGS/ HUMAN FACTORS ENGINEERING/ MICROWAVE LANDING SYSTEMS/ POSITION ERRORS/ RADAR TRACKING/ TERMINAL FACILITIES

ABA: (Author)

ABS: Helicopter IFR routes at hub airports have been investigated in an air-traffic-control system simulation involving a piloted helicopter simulator, computer-generated air traffic, and air traffic controllers. Problems studied included: (1) pilot acceptance of the approach procedure and tracking accuracy; (2) ATC procedures for handling a mix of helicopter and fixed-wing traffic; and (3) utility of the Cockpit Display of Traffic Information (CDTI) for the helicopter. Results indicate that the helicopter routes were pilot acceptable and were noninterfering with fixed-wing traffic. Merging and spacing maneuvers using CDTI were successfully carried out by the pilots, but controllers had some reservations concerning CDTI.

82N23179*# ISSUE 14 PAGE 1893 CATEGORY 34 82/01/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: V/STOL aircraft and fluid dynamic

AUTH: A/ROBERTS, L.; B/ANDERSON, S. B. PAA: A/(Stanford Univ.)

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A19/MF A01

In AGARD Fluid Dyn. of Jets with Appl. to V/STOL 5 p (SEE N82-23150 14-01)

MAJS: /*AIRCRAFT DESIGN/*FIXED WINGS/*FLUID DYNAMICS/*GROUND EFFECT (AERODYNAMICS)/*MILITARY TECHNOLOGY/*V/STOL AIRCRAFT

MINS: / AERODYNAMIC CONFIGURATIONS/ AIRCRAFT PERFORMANCE/ PROPULSIVE EFFICIENCY/ ROTORCRAFT AIRCRAFT/ SHORT TAKEOFF AIRCRAFT

ABA: E.A.K.

ABS: The impact of military applications on rotorcraft and V/STOL aircraft design with respect to fixed wing aircraft is discussed. The influence of the mission needs on the configurational design of V/STOL aircraft, the implications regarding some problems in fluid dynamics relating to propulsive flows, and their interaction with the aircraft and the ground plane, are summarized.

82A19220*# ISSUE 7 PAGE 979 CATEGORY 5 RPT#: AIAA PAPER 81-2655 81/12/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analysis of selected VTOL concepts for a civil transportation mission

AUTH: A/WILSON, S. B., III; B/BOWLES, J. V.; C/FOSTER, J. D. PAA: C/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

American Institute of Aeronautics and Astronautics and NASA Ames Research Center, V/STOL Conference, Palo Alto, CA, Dec. 7-9, 1981, AIAA 19 p.

MAJS: /*AIRCRAFT ENGINES/*CIVIL AVIATION/*TILT ROTOR AIRCRAFT/*TRANSPORT AIRCRAFT/*VERTICAL TAKEOFF AIRCRAFT

MINS: / AIRCRAFT DESIGN/ COST ANALYSIS/ HELICOPTERS/ TURBOFAN ENGINES

ABA: (Author)

ABS: As part of defining the needs and technology

requirements for VTOL aircraft research and development, the objective of this paper is to study the application of two tilt propulsion concept VTOL aircraft to the business/executive transport mission. The two concepts selected for study are the tilt jet concept utilizing rotating turbofan engines for both vertical lift and cruise thrust, and the tilt rotor concept using relatively low disc loading propellers for hover and cruise. Overall mission costs, including the time-value cost of the executives, was computed for a selected range of mission distances, up to the design mission range of 750 nm (1400 km). The total trip cost was also compared to that of a conventional helicopter/business jet combination for a typical executive transport mission.

82A19201*# ISSUE 7 PAGE 979 CATEGORY 5 RPT#: AIAA PAPER 81-2609 81/12/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Ground effect hover characteristics of a large-scale twin tilt-nacelle V/STOL model

AUTH: A/DUDLEY, M. R.; B/FALARSKI, M. D.; C/PISANO, A.; D/HILL, W. G. PAA: B/(NASA, Ames Research Center, Moffett Field, CA); C/(U.S. Navy, Naval Air Systems Command, Washington, DC); D/(Grumman Aerospace Corp., Bethpage, NY)

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; Naval Air Systems Command, Washington, D. C.; Grumman Aerospace Corp., Bethpage, N.Y.
American Institute of Aeronautics and Astronautics and NASA Ames Research Center, V/STOL Conference, Palo Alto, CA, Dec. 7-9, 1981, AIAA 11 p. Research sponsored by the Grumman Aerospace Corp., U.S. Navy, and NASA.

MAJS: /*AERODYNAMIC CHARACTERISTICS/*AIRCRAFT DESIGN/*GROUND EFFECT (AERODYNAMICS)/*HOVERING/*TILT ROTOR AIRCRAFT/*V/STOL AIRCRAFT

MINS: / COMPUTER PROGRAMS/ FLOW DISTRIBUTION/ JET IMPINGEMENT/ PRESSURE DISTRIBUTION/ TILTED PROPELLERS/ WALL JETS

ABA: (Author)

ABS: This paper is a summary of an analysis of the ground-effect characteristics of a large-scale twin-engine, tilt-nacelle V/STOL model. The analysis considers data from the flow field beneath the full-scale model, as well as small-scale model test data, and makes comparisons with jet-ground interactions predicted by a computer code. The data from the large-scale test comprise ground-plane surface temperatures, static pressure distribution and wall-jet total-pressure profiles, fuselage undersurface static pressures, and model forces and moments. The results indicate that the near-field flow is more complex than is indicated by either the small-scale uniform jet studies or the computer predictions. The far-field flow characteristics do show some similarity for these three cases.

82A16914*# ISSUE 5 PAGE 653 CATEGORY 4 RPT#: AIAA PAPER 81-2654 81/12/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helical helicopter approaches with microwave landing system guidance

AUTH: A/MCGEE, L. A.; B/FOSTER, J. D.; C/DUGAN, D. C. PAA: C/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
American Institute of Aeronautics and Astronautics and NASA Ames Research Center, V/STOL Conference, Palo Alto, CA, Dec. 7-9, 1981, AIAA 13 p.

MAJS: /*AIRCRAFT GUIDANCE/*APPROACH CONTROL/*FLIGHT TESTS/*HELICOPTER CONTROL/*MICROWAVE LANDING SYSTEMS

MINS: / AIR TRAFFIC CONTROL/ AIRSPEED/ FEASIBILITY ANALYSIS/ GLIDE LANDINGS/ GLIDE PATHS/ SPACING

ABA: G.R.

ABS: It is desirable that the landing approach of helicopters and V/STOL aircraft into a congested airport equipped with a microwave landing system (MLS) can take place essentially independent of CTOL traffic. The helical approach has been proposed as one way to provide aircraft separation while requiring minimum airspace. A helical descent makes it possible for the helicopter to lose altitude in a confined airspace without descending along an excessively steep glide slope. This avoids helicopter handling problems which occur at slow airspeeds. Preliminary flight-test data are presented regarding the operational feasibility of the helical approach under IFR conditions where the primary guidance information is from an MLS.

82A14392*# ISSUE 3 PAGE 326 CATEGORY 5 RPT#: AIAA PAPER 81-2386 81/11/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: The use of frequency methods in rotorcraft system identification

AUTH: A/DUVAL, R. W. PAA: A/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
AIAA, SETP, SFTE, SAE, ITEA, and IEEE, Flight Testing Conference, 1st, Las Vegas, NV, Nov. 11-13, 1981, AIAA 9 p.

MAJS: /*AIRCRAFT DESIGN/*AIRCRAFT MODELS/*FREQUENCY RESPONSE

/*ROTORCRAFT AIRCRAFT/*SYSTEM IDENTIFICATION
MINS: / MATHEMATICAL MODELS/ REGRESSION ANALYSIS
ABA: (Author)
ABS: A new approach to model structure determination is examined. Flight data from the Rotor Systems Research Aircraft (RSRA) are transformed into the frequency domain and truncated to provide band limiting. The stepwise regression technique is then used to identify a quasistatic state-space model from the transformed data. The data processing requirements for both time domain and frequency domain identification are discussed and the results of the two techniques are compared.

82A13913*# ISSUE 3 PAGE 329 CATEGORY 6 RPT#: AIAA PAPER 81-2516 81/11/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotor systems research aircraft /RSRA/ rotor force and moment measurement system
AUTH: A/BURKS, J. S. PAA: A/(NASA, Ames Research Center, Moffett Field, CA)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AIAA, SETP, SFTE, SAE, ITEA, and IEEE, Flight Testing Conference, 1st, Las Vegas, NV, Nov. 11-13, 1981, AIAA 12 p.
MAJS: /*CALIBRATING/*MEASURING INSTRUMENTS/*ONBOARD EQUIPMENT/*ROTOR AERODYNAMICS/*ROTOR SYSTEMS RESEARCH AIRCRAFT
MINS: / ALGORITHMS/ DATA REDUCTION/ FLEXIBLE BODIES/ STRUCTURAL DESIGN
ABA: (Author)
ABS: The two Rotor Systems Research Aircraft (RSRA) are flight vehicles with unique measurement capabilities. The primary goal of the RSRA is direct measurement of rotor forces and moments in flight. This is accomplished through a rotor force and moment measurement system comprised of load cells and/or hydro-pneumatic isolator units which are integral to the aircraft structure. Due to structural flexibility, the aircraft must undergo a physical calibration. A static calibration of the first RSRA has been completed, and data analysis has progressed through determination of a linear calibration algorithm. Design, development, and operation of the RSRA rotor force and moment measurement system and the Static Calibration Facility are described, and results of the calibration are presented.

82N12040*# ISSUE 3 PAGE 289 CATEGORY 2 RPT#: NASA-TM-81329 A-8732 USAAVRADCOM-TR-81-A-27 81/10/00 350 PAGES UNCLASSIFIED DOCUMENT
UTTL: Performance and loads data from a wind tunnel test of a full-scale, coaxial, hingeless rotor helicopter
AUTH: A/FELKER, F. F., III
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A15/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.
MAJS: /*AERODYNAMIC LOADS/*HELICOPTER PERFORMANCE/*RIGID ROTORS/*ROTOR AERODYNAMICS
MINS: / DRAG REDUCTION/ HUBS/ LOAD TESTS/ STRUCTURAL VIBRATION/ WIND TUNNEL TESTS
ABA: S.E.
ABS: A full-scale XH-59A advancing blade concept helicopter was tested in Ames Research Center's 40 by 80 foot wind tunnel. The helicopter was tested with the rotor on and off, rotor hub fairings on and off, interrotor shaft fairing on and off, rotor instrumentation module on and off, and auxiliary propulsion thrust on and off. An advance ratio range of 0.25 and 0.45 with the rotor on and from 60 to 180 knots with the rotor off was investigated. Data on aerodynamic forces and moments, rotor loads, rotor control positions and viration for the XH-59A as well as the aerodynamic performance of the isolated rotor are presented.

82N10029*# ISSUE 1 PAGE 5 CATEGORY 5 RPT#: NASA-TM-81328 A-8730 81/10/00 8 PAGES UNCLASSIFIED DOCUMENT
UTTL: V/STOL aircraft and fluid dynamics
AUTH: A/ROBERTS, L.; B/ANDERSON, S. B. PAA: A/(Stanford Univ., Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01
MAJS: /*AIRCRAFT CONFIGURATIONS/*AIRCRAFT DESIGN/*FLUID DYNAMICS/*THRUST CONTROL/*V/STOL AIRCRAFT
MINS: / JET FLOW/ JET LIFT/ MILITARY OPERATIONS/ PROPULSION SYSTEM PERFORMANCE
ABA: B.W.
ABS: The impact of military applications on rotorcraft and V/STOL aircraft design is summarized with respect to fixed-wing aircraft. The influence of the mission needs on the configurational design of V/STOL aircraft, the implications regarding some problems in fluid dynamics relating to propulsive flows, and their interaction with the aircraft and the ground plane, are also considered. Additional research in fluid dynamics that can contribute to an improvement in

performance of V/STOL aircraft is suggested.

82N17224*# ISSUE 8 PAGE 1038 CATEGORY 7
81/09/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Component research for future propulsion systems
AUTH: A/WALKER, C. L.; B/WEDEN, G. J.; C/ZUK, J. PAA: A/(Army Propulsion Lab., Cleveland, Ohio); B/(Army Propulsion Lab., Cleveland, Ohio)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A13/MF A01
In AGARD Helicopter Propulsion Systems 12 p (SEE N82-17203 08-07)
MAJS: /*COMPONENT RELIABILITY/*HELICOPTER ENGINES/* HELICOPTER PERFORMANCE/*LIFE CYCLE COSTS/*PROPULSION SYSTEM CONFIGURATIONS
MINS: / COST ANALYSIS/ ECONOMIC ANALYSIS/ MILITARY TECHNOLOGY/ OPERATING COSTS/ PROPULSIVE EFFICIENCY
ABA: E.A.K.
ABS: The factors affecting the helicopter market for the past, present, and future are reviewed. Acquisition cost, mission reliability, life cycle cost and civil and military aspects are reviewed. The potential for advanced vehicle configurations with substantial improvements in energy efficiency, operating economics, and characteristics to satisfy the demands of the future market are identified. Advanced propulsion systems required to support these vehicle configurations and the component technology for the engine systems are discussed. The selection of components in areas of economics and efficiency is considered.

82N12042*# ISSUE 3 PAGE 289 CATEGORY 2 RPT#: NASA-TM-81232 A-8332 USAAVRADCOM-TR-81-A-23 81/09/00
61 PAGES UNCLASSIFIED DOCUMENT
UTTL: Experimental and analytical studies of a model helicopter rotor in hover
AUTH: A/CARADONNA, F. X.; B/TUNG, C.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A04/MF A01
Prepared jointly with Army Aviation Research and Development Command Presented at the 6th European Rotorcraft and Powered Lift Aircraft Forum, Bristol, England, 16-19 Sep. 1980
MAJS: /*BLADE TIPS/*HELICOPTER WAKES/*HOVERING/*ROTOR AERODYNAMICS/*VORTICES
MINS: / FLOW GEOMETRY/ PREDICTION ANALYSIS TECHNIQUES/ PRESSURE DISTRIBUTION/ TRANSONIC FLOW
ABA: J.M.S.
ABS: A benchmark test to aid the development of various rotor performance codes was conducted. Simultaneous blade pressure measurements and tip vortex surveys were made for a wide range of tip Mach numbers including the transonic flow regime. The measured tip vortex strength and geometry permit effective blade loading predictions when used as input to a prescribed wake lifting surface code. It is also shown that with proper inflow and boundary layer modeling, the supercritical flow regime can be accurately predicted.

81N33157*# ISSUE 24 PAGE 3290 CATEGORY 2 RPT#: NASA-TM-81320 A-8692 USAAVRADCOM-TR-81-A-24 PAPER-32
81/09/00 22 PAGES UNCLASSIFIED DOCUMENT
UTTL: Prediction of blade-vortex interaction noise from measured blade pressure
AUTH: A/NAKAMURA, Y.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif. Presented at 7th European Rotorcraft and Powered Lift Aircraft Forum
MAJS: /*BLADE SLAP NOISE/*BLADE TIPS/*HELICOPTERS/*NOISE PREDICTION (AIRCRAFT)/*ROTOR AERODYNAMICS/*VORTICES
MINS: / ACOUSTIC MEASUREMENT/ LEADING EDGES/ MATHEMATICAL MODELS/ PRESSURE DISTRIBUTION/ WAVEFORMS
ABA: Author
ABS: The impulsive nature of noise due to the interaction of a rotor blade with a tip vortex is studied. The time signature of this noise is calculated theoretically based on the measured blade surface pressure fluctuation of an operational load survey rotor in slow descending flight and is compared with the simultaneous microphone measurement. Particularly, the physical understanding of the characteristic features of a waveform is extensively studied in order to understand the generating mechanism and to identify the important parameters. The interaction trajectory of a tip vortex on an acoustic planform is shown to be a very important parameter for the impulsive shape of the noise. The unsteady nature of the pressure distribution at the very leading edge is also important to the pulse shape. The theoretical model using noncompact liner acoustics predicts the general shape of interaction impulse pretty well except for peak amplitude which requires more continuous information along the span at the leading edge.

81N31185*# ISSUE 22 , PAGE 3014 CATEGORY 5 RPT#: NASA-TP-1921 A-8022 81/09/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Vehicle concepts and technology requirements for buoyant heavy-lift systems

AUTH: A/ARDEMA, M. D.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*AIRCRAFT DESIGN/*AIRSHIPS/*COST ANALYSIS/*HEAVY LIFT HELICOPTERS/*TECHNOLOGY ASSESSMENT

MINS: / BUOYANCY/ CARGO AIRCRAFT/ FEASIBILITY ANALYSIS/ INFLATABLE STRUCTURES

ABA: Author

ABS: Several buoyant-vehicle (airship) concepts proposed for short hauls of heavy payloads are described. Numerous studies identified operating cost and payload capacity advantages relative to existing or proposed heavy-lift helicopters for such vehicles. Applications involving payloads of from 15 tons up to 800 tons were identified. The buoyant quad-rotor concept is discussed in detail, including the history of its development, current estimates of performance and economics, currently perceived technology requirements, and recent research and technology development. It is concluded that the buoyant quad-rotor, and possibly other buoyant vehicle concepts, has the potential of satisfying the market for very heavy vertical lift but that additional research and technology development are necessary. Because of uncertainties in analytical prediction methods and small-scale experimental measurements, there is a strong need for large or full-scale experiments in ground test facilities and, ultimately, with a flight research vehicle.

81A44556*# ISSUE 21 PAGE 3616 CATEGORY 4 RPT#: AIAA PAPER 81-1857 81/08/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Automatic helical rotorcraft descent and landing using a Microwave Landing System

AUTH: A/MCGEE, L. A.; B/FOSTER, J. D.; C/XENAKIS, G. PAA: C/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, Albuquerque, NM, Aug. 19-21, 1981, 11 p.

MAJS: /*AIRCRAFT LANDING/*AUTOMATIC LANDING CONTROL/* INSTRUMENT APPROACH/*MICROWAVE LANDING SYSTEMS/*ROTARY WING AIRCRAFT

MINS: / AIR NAVIGATION/ AIRCRAFT GUIDANCE/ AVIONICS/ AZIMUTH / DESCENT/ FEASIBILITY/ FLIGHT TESTS/ HOVERING/ INSTRUMENT FLIGHT RULES/ LANDING SITES/ UH-1 HELICOPTER

ABA: (Author)

ABS: A helical-approach concept is presented for Instrument Flight Rules (IFR) operation of rotorcraft into congested terminal areas where separation from high-speed jet traffic is highly desirable and the airport-precision-approach aid is a Microwave Landing System (MLS). The concept takes advantage of the fact that rotorcraft need not land on the main runway but can operate from a pad that lies on an MLS radial offset from the centerline. The results of 48 flights using a UH-1H helicopter and a research avionics system are presented. Three levels of navigation sophistication were also investigated. It is shown that an approach helix can be contained in a relatively small volume and that being within the Instrument Landing System (ILS) Category II window at a 30-m (100-ft) altitude is not a requirement for a successful hover over a landing pad. Only two of the three navigation systems provided estimates that allowed all flights to descend from hover to touchdown.

81A44554*# ISSUE 21 PAGE 3625 CATEGORY 8 RPT#: AIAA PAPER 81-1855 81/08/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Kinematic properties of rotary-wing and fixed-wing aircraft in steady coordinated high-g turns

AUTH: A/CHEN, R. T. N. PAA: A/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. American Institute of Aeronautics and Astronautics, Atmospheric Flight Mechanics Conference, Albuquerque, NM, Aug. 19-21, 1981, 15 p.

MAJS: /*ACCELERATION (PHYSICS)/*AIRCRAFT MANEUVERS/*CRITICAL LOADING/*FIXED WINGS/*KINEMATICS/*ROTARY WING AIRCRAFT

MINS: / AERODYNAMIC LOADS/ AIRCRAFT STABILITY/ ANGLE OF ATTACK/ CONTROLLABILITY/ FLIGHT CHARACTERISTICS/ FLIGHT MECHANICS/ HELICOPTER CONTROL

ABA: J.F.

ABS: An analytical approach to the study of flight dynamics of aircraft operating in a high-angle-of-attack flight regime and of helicopters operating in extreme thrust conditions is presented. Steady coordinated high-g turns are used to establish the initial equilibrium flight conditions near stall angles of attack. The kinematic properties of the aircraft in steady coordinated turns are examined: in high-g turns, pitch rate (independent of the angle of attack) is of a much larger magnitude than roll and yaw rate; a substantial roll rate is found to develop in steep turns for all

angles of attack; the angle of attack also has a significant effect on the pitch attitude, with decreasing influence as the normal load factor increases. The exact small disturbance equations of motion of the aircraft in general steady turns are also developed for application to both rotary-wing and fixed-wing aircraft in extreme conditions. These equations are in a first-order, vector-matrix format, and are thus compatible with many efficient software packages developed in modern system theory.

82N10012*# ISSUE 1 PAGE 2 CATEGORY 2 RPT#: NASA-TM-81316 A-8683 USAAVRADCOM-TR-81-A-25 81/08/00 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: The structure of trailing vortices generated by model rotor blades

AUTH: A/TUNG, C.; B/PUCCI, S. L.; C/CARADONNA, F. X.; D/NORSE, H. A.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Moffet Field, Calif.
Presented at Seventh European Rotorcraft and Powered Lift Aircraft Forum, Garmisch-Partenkirchen, West Germany, 8-11 Sep. 1981

MAJS: /*BLADE TIPS/*HELICOPTER WAKES/*HIGH ASPECT RATIO/* LOAD DISTRIBUTION (FORCES)/*ROTARY WINGS

MINS: / AERODYNAMIC INTERFERENCE/ AIRCRAFT MODELS/ HOT-WIRE ANEMOMETERS/ MATHEMATICAL MODELS/ TURBULENT FLOW

ABA: S.L.

ABS: Hot-wire anemometry to analyze the structure and geometry of rotary wing trailing vortices is studied. Tests cover a range of aspect ratios and blade twist. For all configurations, measured vortex strength correlates well with maximum blade-bound circulation. Measurements of wake geometry are in agreement with classical data for high-aspect ratios. The detailed vortex structure is similar to that found for fixed wings and consists of four well defined regions--a viscous core, a turbulent mixing region, a merging region, and an inviscid outer region. A single set of empirical formulas for the entire set of test data is described.

81N32137*# ISSUE 23 PAGE 3148 CATEGORY 5 RPT#: NASA-TM-81321 A-8696 81/08/00 287 PAGES UNCLASSIFIED DOCUMENT

UTTL: A full-scale wind tunnel investigation of a helicopter bearingless main rotor --- Ames 40 by 80 Wind Tunnel

AUTH: A/WARMBRODT, W.; B/MCCLOUD, J. L., II

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A13/MF A01

MAJS: /*AERODYNAMIC CHARACTERISTICS/*BEARINGLESS ROTORS/* ROTARY WINGS

MINS: / AEROELASTICITY/ HELICOPTERS/ LOADS (FORCES)/ ROTOR AERODYNAMICS/ WIND TUNNEL TESTS

ABA: R.C.T.

ABS: A helicopter bearingless main rotor was tested. Areas of investigation included aeroelastic stability, aerodynamic performance, and rotor loads as a function of collective pitch setting, RPM, airspeed and shaft angle. The rotor/support system was tested with the wind tunnel balance dampers installed and, subsequently, removed. Modifications to the rotor hub were tested. These included a reduction in the rotor control system stiffness and increased flexbeam structural damping. The primary objective of the test was to determine aeroelastic stability of the fundamental flexbeam/blade chordwise bending mode. The rotor was stable for all conditions. Damping of the rotor chordwise bending mode increases with increased collective pitch angle at constant operating conditions. No significant decrease in rotor damping occured due to frequency coalescence between the blade chordwise fundamental bending mode and the support system.

81N33146# ISSUE 24 PAGE 3288 CATEGORY 9 81/06/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: The role of the research simulator in the systems development of rotorcraft

AUTH: A/STATLER, I. C.; B/DEEL, A.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A12/MF A01
In AGARD The Impact of Mil. Appl. on Rotorcraft and V/STOL Aircraft Design 21 p (SEE N81-33137 24-01)
Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.

MAJS: /*AIRCRAFT DESIGN/*FLIGHT SIMULATORS/*RESEARCH AND DEVELOPMENT/*ROTORCRAFT AIRCRAFT

MINS: / REAL TIME OPERATION/ RESEARCH FACILITIES/ SYSTEMS ENGINEERING/ TRAINING DEVICES

ABA: T.M.

ABS: Over the last 20 years, flight simulators became widely accepted as training tools. Moreover, research simulators were used extensively by the fixed-wing industry: in the design, testing, and certification of new aircraft. The rotorcraft industry, however, was slow to use man-in-the-loop simulation to solve its design problems, primarily because of the difficulty

of modeling complex rotorcraft for realtime simulation and because of the need for a wide-angle visual system for low-level flight. A joint U.S. Army and NASA program was initiated to provide this simulation capability for exploitation by both government and industry. The potential application of the research simulator to future rotorcraft systems design, development, product improvement evaluations, and safety analysis is discussed.

81A38058*# ISSUE 17 PAGE 2888 CATEGORY 7
81/05/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Component research for future propulsion systems
AUTH: A/WALKER, C. L.; B/WEDEN, G. J.; C/ZUK, J. PAA: B/(U.S. Army, Propulsion Laboratory, Cleveland, OH); C/(NASA, Ames Research Center, Moffett Field, CA)
CORP: Army Propulsion Lab., Cleveland, Ohio.; National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NATO, AGARD, Specialists' Meeting, 57th, Toulouse, France, May 11-14, 1981, Paper, 14 p.
MAJS: /*AIRCRAFT ENGINES/*AIRCRAFT RELIABILITY/*ENERGY CONVERSION EFFICIENCY/*HELICOPTER DESIGN/*LIFE CYCLE COSTS/*PROPULSION SYSTEM PERFORMANCE
MINS: / AIRCRAFT MAINTENANCE/ AIRCRAFT PARTS/ ENGINE DESIGN/ ENGINE PARTS/ FUEL CONSUMPTION/ TECHNOLOGICAL FORECASTING/ TURBOCOMPRESSORS
ABA: E.B.
ABS: A review of factors related to the acquisition and life-cycle cost, and mission reliability of helicopters is given. The potential for advanced vehicle configurations with improvements in energy efficiency, operating economics, and characteristics to satisfy the demands of the future market are identified. Special attention is given to advanced propulsion systems and related component technologies, and system requirements, powerplants and component thrusts, compressor designs, combustion systems, turbine efficiency, blade tip treatment concepts and shaft dynamics are discussed in detail.

81A42749* ISSUE 20 PAGE 3453 CATEGORY 1 RPT#: SAE PAPER 810589 81/04/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotorcraft researchers and operators - Is there is common ground
AUTH: A/TALBOT, P. D.; B/SNYDER, W. J. PAA: B/(NASA, Ames Research Center, Aeronautical Systems Branch, Moffett Field, CA)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
Society of Automotive Engineers, Business Aircraft Meeting and Exposition, Wichita, KS, Apr. 7-10, 1981, 18 p.
MAJS: /*HELICOPTER DESIGN/*NASA PROGRAMS/*OPERATIONAL PROBLEMS/*ROTORCRAFT AIRCRAFT
MINS: / AIRCRAFT PARTS/ AVIONICS/ CIVIL AVIATION/ HELICOPTER ENGINES/ PROPULSION SYSTEM PERFORMANCE
ABA: G.R.
ABS: An investigation is conducted concerning the extent to which a program for rotorcraft research presented by NASA meets the user needs. Problems of civil operators are examined, taking into account powerplants, reliability and maintainability, environment, noise and vibration, and lack of space for passengers' baggage. A description of applicable technology is provided, giving attention to aerodynamics and structures, propulsion, power transfer methodology, flight control, avionic systems, human factors, and vehicle configurations. One of the most difficult challenges in trying to bring research to bear on operator problems is that in general researchers are working on long-term solutions while operators are seeking short-term answers. Attention is also given to potential technological bright spots, higher risk technologies, highest technological risks, and advanced vehicle configurations.

81N27061*# ISSUE 18 PAGE 2328 CATEGORY 3 RPT#: NASA-TM-81301 A-8606 81/04/00 55 PAGES UNCLASSIFIED DOCUMENT

UTTL: ATC simulation of helicopter IFR approaches into major terminal areas using RNAV, MLS, and CDTI
AUTH: A/TOBIAS, L.; B/LEE, H. Q.; C/PEACH, L. L.; D/WILLETT, F. M., JR.; E/OBRIEN, P. J. PAA: D/(FAA, Atlantic City); E/(FAA, Atlantic City)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*AIR TRAFFIC CONTROL/*APPROACH INDICATORS/*AREA NAVIGATION/*FLIGHT SIMULATION/*HELICOPTERS/*MICROWAVE LANDING SYSTEMS
MINS: / AIRCRAFT APPROACH SPACING/ APPROACH CONTROL/ INSTRUMENT APPROACH/ INSTRUMENT FLIGHT RULES
ABA: Author
ABS: The introduction of independent helicopter IFR routes at hub airports was investigated in a real time air traffic control system simulation involving a piloted helicopter simulator, computer generated air traffic, and air traffic controllers. The helicopter simulator was equipped to fly area navigation (RNAV) routes and microwave landing system approaches. Problems studied included: (1) pilot acceptance of the approach procedure and tracking accuracy; (2) ATC procedures for handling a mix of helicopter and fixed wing

traffic; and (3) utility of the cockpit display of traffic information (CDTI) for the helicopter in the hub airport environment. Results indicate that the helicopter routes were acceptable to the subject pilots and were noninterfering with fixed wing traffic. Merging and spacing maneuvers using CDTI were successfully carried out by the pilots, but controllers had some reservations concerning the acceptability of the CDTI procedures.

B1N22039*# ISSUE 13 PAGE 1717 CATEGORY 5 RPT#: NASA-TP-1773 A-8399 81/04/00 41 PAGES UNCLASSIFIED DOCUMENT

UTTL: Kinematic properties of the helicopter in coordinated turns

AUTH: A/CHEN, R. T. N.; B/JESKE, J. A.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*ANGLE OF ATTACK/*HELICOPTERS/*KINEMATIC EQUATIONS/*PITCHING MOMENTS/*ROLL/*SIDESLIP

MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC LOADS/ HELICOPTER PERFORMANCE

ABA: S.F.

ABS: A study on the kinematic relationship of the variables of helicopter motion in steady, coordinated turns involving inherent sideslip is described. A set of exact kinematic equations which govern a steady coordinated helical turn about an Earth referenced vertical axis is developed. A precise definition for the load factor parameter that best characterizes a coordinated turn is proposed. Formulas are developed which relate the aircraft angular rates and pitch and roll attitudes to the turn parameters, angle of attack, and inherent sideslip. A steep, coordinated helical turn at extreme angles of attack with inherent sideslip is of primary interest. The bank angle of the aircraft can differ markedly from the tilt angle of the normal load factor. The normal load factor can also differ substantially from the accelerometer reading along the vertical body axis of the aircraft. Sideslip has a strong influence on the pitch attitude and roll rate of the helicopter. Pitch rate is independent of angle of attack in a coordinated turn and in the absence of sideslip, angular rates about the stability axes are independent of the aerodynamic characteristics of the aircraft.

B1N20066*# ISSUE 11 PAGE 1438 CATEGORY 5 RPT#: NASA-TM-81281 A-8512 81/03/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Recent progress in V/STOL aircraft technology TLSP: Final Report

AUTH: A/ROBERTS, L.; B/DECKERT, W.; C/HICKEY, D.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*FLIGHT TESTS/*RESEARCH AIRCRAFT/*SHORT HAUL AIRCRAFT/*TILT ROTOR AIRCRAFT/*TURBOFAN AIRCRAFT/*V/STOL AIRCRAFT/*WIND TUNNEL TESTS

MINS: / NACELLES/ QUIET ENGINE PROGRAM/ UPPER SURFACE BLOWN FLAPS

ABA: Author

ABS: Results from wind tunnel and flight tests investigations for V/STOL aircraft are reviewed. Primary emphasis is given to technical results relating to three types of subsonic aircraft: a quiet STOL aircraft; a tilt rotor aircraft; and a turbofan V/STOL aircraft. Comparison and correlation between theoretical and experimental results and between wind tunnel and flight test results, is made. The quiet STOL aircraft technology results are primarily those derived from the NASA/Boeing Quiet Short Haul Technology (QSRA) program. The QSRA aircraft uses an upper surface blown flap and develops a usable engine-out landing approach lift coefficient of 5.5 and landing distances less than 1,000 ft. The tilt rotor aircraft technology results are those obtained from the NASA/Army/Navy/Bell (XV-15-TRRA) aircraft flight investigations. The TRRA is a twin rotor research aircraft capable of vertical takeoff and landing and cruise speeds of 300 knots. The turbofan V/STOL aircraft technology results are from static ground facility and wind tunnel investigations of a NASA/NAVY/Grumman full scale lift/cruise fan aircraft model, which features two tilting nacelles with TF-34 engines.

B1N19101*# ISSUE 10 PAGE 1303 CATEGORY 5 RPT#: NASA-TM-81276 USAAVRADCOM-TR-81-A-7 81/03/00 25 PAGES UNCLASSIFIED DOCUMENT

UTTL: The role of the research simulator in the systems development of rotorcraft

AUTH: A/STATLER, I. C.; B/DEEL, A.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01
Prepared in cooperation with Army Aviation and Development Command, Moffet Field, Calif.

MAJS: /*COMPUTERIZED SIMULATION/*FLIGHT SIMULATION/*FLIGHT

SIMULATORS/*HELICOPTER DESIGN/*ROTARY WING AIRCRAFT
MINS: / COMPUTERS/ HELMET MOUNTED DISPLAYS/ IMAGING TECHNIQUES/ PROJECTORS/ VERTICAL MOTION SIMULATORS
ABA: M.G.
ABS: The potential application of the research simulator to future rotorcraft systems design, development, product improvement evaluations, and safety analysis is examined. Current simulation capabilities for fixed-wing aircraft are reviewed and the requirements of a rotorcraft simulator are defined. The visual system components, vertical motion simulator, cab, and computation system for a research simulator under development are described.

81N19042*# ISSUE 10 PAGE 1295 CATEGORY 3 81/03/00 20 PAGES UNCLASSIFIED DOCUMENT
UTTL: Flight tests of IFR landing approach systems for helicopters
AUTH: A/BULL, J. S.; B/HEGARTY, D. M.; C/PEACH, L. L.; D/PHILLIPS, J. D.; E/ANDERSON, D. J.; F/DUGAN, D. C.; G/ROSS, V. L.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 1 p 145-164 (SEE N81-19035 10-03)
MAJS: /*AIRBORNE RADAR APPROACH/*FLIGHT TESTS/*HELICOPTERS/*INSTRUMENT FLIGHT RULES/*MICROWAVE LANDING SYSTEMS/*STANDARDS
MINS: / ALL-WEATHER AIR NAVIGATION/ APPROACH/ GLIDE PATHS/ OFFSHORE PLATFORMS/ RADAR SIGNATURES
ABA: A.R.H.
ABS: Joint NASA/FAA helicopter flight tests were conducted to investigate airborne radar approaches (ARA) and microwave landing system (MLS) approaches. Flight-test results were utilized to prove NASA with a data base to be used as a performance measure for advanced guidance and navigation concepts, and to provide FAA with data for establishment of TERPS criteria. The first flight-test investigation consisted of helicopter IFR approaches to offshore oil rigs in the Gulf of Mexico, using weather/mapping radar, operational pilots, and a Bell 212 helicopter. The second flight-test investigation consisted of IFR MLS approaches at Crows Landing (near Ames Research Center), with a Bell UH-1H helicopter, using NASA, FAA, and operational industry pilots. Tests are described and results discussed.

81A20596*# ISSUE 7 PAGE 1146 CATEGORY 71 RPT#: AIAA PAPER 81-0092 81/01/00 13 PAGES UNCLASSIFIED DOCUMENT
UTTL: Acoustics of rotors utilizing circulation control
AUTH: A/MOSHER, M. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 19th, St. Louis, Mo., Jan. 12-15, 1981. 13 p.
MAJS: /*ACOUSTIC PROPERTIES/*AIRCRAFT NOISE/*CIRCULATION CONTROL ROTORS/*HELICOPTER CONTROL/*NOISE SPECTRA/*X WING ROTORS
MINS: / BACKGROUND NOISE/ FULL SCALE TESTS/ NOISE INTENSITY/ NOISE MEASUREMENT/ ROTOR LIFT/ ROTOR SPEED
ABA: (Author)
ABS: The acoustic characteristics of circulation-controlled rotors are examined by comparing data from three full-scale rotors: a conventional rotor, the X-Wing rotor, and the Circulations Control Rotor. Both the X-Wing rotor and Circulation Control Rotor had higher sound levels than the conventional rotor at identical advancing-tip Mach numbers. There is excess noise due to the compressor on the X-Wing rotor and excess broadband noise on the Circulation Control Rotor. The X-Wing rotor had lower sound levels than the conventional rotor at identical forward speeds because of the lower tip speed feasible with the use of circulation control.

82A14407* ISSUE 3 PAGE 327 CATEGORY 5 81/00/00 32 PAGES UNCLASSIFIED DOCUMENT
UTTL: Development of a comprehensive analysis for rotorcraft. II - Aircraft model, solution procedure and applications
AUTH: A/JOHNSON, W. PAA: A/(NASA, Ames Research Center; U.S. Army, Aeromechanics Laboratory, Moffett Field, CA)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif.
Vertica, vol. 5, no. 3, 1981, p. 185-216.
MAJS: /*AERODYNAMIC LOADS/*AIRCRAFT DESIGN/*AIRCRAFT MODELS/*AIRCRAFT PERFORMANCE/*ROTARY WING AIRCRAFT/*STRUCTURAL ANALYSIS
MINS: / AERODYNAMIC STABILITY/ AEROELASTICITY/ AIRCRAFT CONFIGURATIONS/ COMPUTER PROGRAMS/ DEGREES OF FREEDOM
ABA: (Author)
ABS: The development of a comprehensive analytical model of rotorcraft aerodynamics and dynamics is described. Particular emphasis is given to describing the reasons

behind the choices and decisions involved in constructing the model. The analysis is designed to calculate rotor performance, loads and noise; helicopter vibration and gust response; flight dynamics and handling qualities; and system aeroelastic stability. It is intended for use in the design, testing and evaluation of a wide class of rotors and rotorcraft and to be the basis for further development of rotary wing theories. The general characteristics of the geometric, structural, inertial and aerodynamic models used for the rotorcraft components are described, including the assumptions introduced by the chosen models and the resulting capabilities and limitations. Finally, some examples from recent applications of the analysis are given.

82A13125* ISSUE 3 PAGE 331 CATEGORY 8 81/00/00
7 PAGES UNCLASSIFIED DOCUMENT

UTTL: The design of exact nonlinear model followers --- with application to trajectory autopilot for helicopter

AUTH: A/MEYER, G. PAA: A/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

In: Joint Automatic Control Conference, Charlottesville, VA, June 17-19, 1981, Proceedings. Volume 2. (A82-13076 03-63) New York, American Institute of Chemical Engineers, 1981. 7 p. (FA-3A).

MAJS: /*AUTOMATIC PILOTS/*DYNAMIC CONTROL/*FEEDBACK CONTROL/*HELICOPTER CONTROL/*NONLINEAR SYSTEMS/*SYSTEMS ENGINEERING

MINS: / COMPLEX SYSTEMS/ DYNAMIC MODELS/ LINEARIZATION/ MATHEMATICAL MODELS/ STATE VECTORS/ TIME DEPENDENCE/ TRAJECTORY CONTROL/ TRANSFORMATIONS (MATHEMATICS)

ABA: (Author)

ABS: A practical approach to the design of control systems for strongly nonlinear, multivariable, time-dependent plants is described. The structure of the control system is that of an exact model follower. The model dynamics are decoupled, linear, constant, and of the order of the plant. The plant state and controls are transformed so that the plant, when viewed through these transformations, looks like the simple model. Regulation of disturbances is accomplished by means of the transformed state and controls. Conditions for transformability into linear models, the appropriate models, and the construction of the transformations are discussed. The approach is illustrated on a trajectory autopilot for a helicopter.

81A46646*# ISSUE 22 PAGE 3817 CATEGORY 8
81/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: A piloted simulation of the backup control system engagement for the YAH-64

AUTH: A/BLANKEN, C. L.; B/AIKEN, E. W.; C/MERRILL, R. K.; D/ROSS, V. L. PAA: C/(U.S. Army, Aeromechanics Laboratory, Moffett Field, CA); D/(NASA, Ames Research Center, Moffett Field, CA)

CORP: Army Research and Technology Labs., Moffett Field, Calif.; National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

In: American Helicopter Society, Annual Forum, 37th, New Orleans, LA, May 17-20, 1981, Proceedings. (A81-46603 22-01) Washington, DC, American Helicopter Society, 1981, p. 484-492.

MAJS: /*AH-64 HELICOPTER/*AIRCRAFT PILOTS/*BACKUPS/*CONTROL SIMULATION/*HELICOPTER CONTROL/*OPTIMAL CONTROL

MINS: / AUTOMATIC FLIGHT CONTROL/ CONTROL EQUIPMENT/ FEEDBACK CONTROL/ FLIGHT TESTS/ PILOT TRAINING

ABA: (Author)

ABS: A piloted simulator experiment, designed to evaluate and optimize certain backup control system (BUCS) engagement parameters and to provide pilot familiarization with aircraft response prior to flight test of the BUCS in the YAH-64 Advanced Attack Helicopter, is described. Key elements of the simulation were the representation of a control system jam, the pilot's breaking of a shear pin in the jammed control, and the resultant BUCS engagement. To minimize the excursions in aircraft motion which could result from the pilot's control inputs after shear pin breakage, the BUCS control function is blended in gradually. The experiment's results indicate that optimum time to full control authority after shear pin breakage is three seconds in all axes for certain critical tasks. Special pilot training in the recovery from a control system jam may be necessary to minimize unacceptably large aircraft transients in the off-axis.

81A46644*# ISSUE 22 PAGE 3817 CATEGORY 8
81/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Influence of sideslip on the kinematics of the helicopter in steady coordinated turns

AUTH: A/CHEN, R. T. N.; B/JESKE, J. A. PAA: B/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

In: American Helicopter Society, Annual Forum, 37th, New Orleans, LA, May 17-20, 1981, Proceedings. (A81-46603 22-01) Washington, DC, American Helicopter Society, 1981, p. 463-477.

MAJS: /*AIRCRAFT MANEUVERS/*ANGLE OF ATTACK/*HELICOPTER PERFORMANCE/*KINEMATICS/*SIDESLIP
MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC LOADS/ HELICOPTER CONTROL/ PITCH (INCLINATION)/ ROLLING MOMENTS/ TURNING FLIGHT
ABA: (Author)
ABS: A steep coordinated helical turn at extreme angles of attack with inherent sideslip is of primary interest in this study. Unlike fixed-wing aircraft, the helicopter in a steady coordinated turn will inherently sideslip. A set of exact kinematic equations describing this motion in steady helical turns has been developed, and a rational definition for the load factor that best characterizes a coordinated turn for a helicopter has been proposed. An analysis has also been completed on the effects of sideslip on the kinematic relationships in a coordinated turn which is based on new closed-form solutions which relate the aircraft angular rates and pitch and roll attitudes to the turn parameters, angle of attack, and sideslip. The results show that the bank angle of the aircraft can differ markedly from the tilt angle of the normal load factor and that the normal load factor can also differ substantially from the accelerometer reading along the vertical body axis of the aircraft. Generally, sideslip has a strong influence on the pitch attitude and roll rate of the helicopter. The study also indicates that pitch rate is independent of angle of attack in a coordinated turn and that in the absence of sideslip, angular rates about the stability axes are independent of the aerodynamic characteristics of the aircraft.

81A46623*# ISSUE 22 PAGE 3816 CATEGORY 8
81/00/00 15 PAGES UNCLASSIFIED DOCUMENT
UTTL: A flight investigation of static stability, control augmentation, and flight director influences on helicopter IFR handling qualities
AUTH: A/LEBACQZ, J. V.; B/WEBER, J. M.; C/CORLISS, L. D.
PAA: B/(NASA, Ames Research Center, Moffett Field, CA); C/(U.S. Army, Aeromechanics Laboratory, Moffett Field, CA)
CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; Army Research and Technology Labs., Moffett Field, Calif.
In: American Helicopter Society, Annual Forum, 37th, New Orleans, LA, May 7-20, 1981, Proceedings. (A81-46603 22-01) Washington, DC, American Helicopter Society, 1981, p. 237-251.
MAJS: /*AIRCRAFT STABILITY/*FLIGHT CONTROL/*HELICOPTER CONTROL/*INSTRUMENT FLIGHT RULES/*STATIC STABILITY
MINS: / AIRCRAFT EQUIPMENT/ AUGMENTATION/ FLIGHT MECHANICS/ FLIGHT SIMULATION/ FLIGHT TESTS/ LONGITUDINAL CONTROL
ABS: A flight experiment was conducted using the NASA-Army V/STOLAND UH-1H variable-stability helicopter to investigate the influence of several longitudinal-static-stability, control-augmentation, and flight-director parameters on helicopter flying qualities during terminal area operations in instrument conditions. This experiment, which was part of a joint NASA/FAA program pertaining to helicopter IFR airworthiness, was designed to corroborate and extend previous ground simulation results obtained in this program. Variations examined included stable and neutral longitudinal control position gradients, rate-damping and attitude-command augmentation, and raw data versus flight-director displays. Pilot rating results agreed excellently with the ground simulation data, indicating an adequate instrument capability with rate-damping augmentation and neutral statics and the need for pitch-roll attitude augmentation to achieve a satisfactory system.

81A44110*# ISSUE 21 PAGE 3624 CATEGORY B RPT#: AIAA 81-1820 81/00/00 15 PAGES UNCLASSIFIED DOCUMENT
UTTL: Investigation of control, display, and crew-loading requirements for helicopter instrument approach
AUTH: A/LEBACQZ, J. V.; B/GERDES, R. M.; C/FORREST, R. D.; D/MERRILL, R. K. PAA: B/(NASA, Ames Research Center, Moffett Field, CA); C/(FAA, Moffett Field, CA); D/(U.S. Army, Aeromechanics Laboratory, Moffett Field, CA)
CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; Federal Aviation Administration, Moffett Field, Calif.; Army Research and Technology Labs., Moffett Field, Calif.
In: Guidance and Control Conference, Albuquerque, NM, August 19-21, 1981, Collection of Technical Papers. (A81-44076 21-12) New York, American Institute of Aeronautics and Astronautics, Inc., 1981, p. 281-295.
MAJS: /*AIRCRAFT INSTRUMENTS/*DISPLAY DEVICES/*FLIGHT SIMULATION/ HELICOPTER CONTROL/*INSTRUMENT APPROACH/*WORKLOADS (PSYCHOPHYSIOLOGY)
MINS: / AIRCRAFT GUIDANCE/ AIRCRAFT RELIABILITY/ CONTROLLABILITY/ FLIGHT CONTROL/ GROUND TESTS/ HELICOPTER DESIGN/ PILOT PERFORMANCE
ABA: (Author)
ABS: A ground simulation experiment was conducted on a flight simulator for advanced aircraft to investigate the influence and interaction of flight-control system, flight-director display, and crew-loading situation on helicopter flying qualities during terminal-area operations in instrument conditions. Six levels of control complexity were implemented on a representative helicopter model. The six levels of

augmentation were examined with display variations consisting of raw elevation and azimuth data only and of raw data plus one-, two-, and three-cue flight directors. Crew-loading situations simulated for the control-display combinations were dual-pilot operation and single-pilot operation. Four pilots performed a total of 150 evaluations of combinations of these parameters for a representative microwave landing system approach task. Pilot rating results indicated the existence of a control display trade-off for ratings of satisfactory, whereas ratings of adequate-but-unsatisfactory depended primarily on the control system; the control system required for ratings of adequate-but-unsatisfactory was clearly more complex for the single-pilot situation than that for the dual-pilot situation.

81A39896* ISSUE 18 PAGE 3071 CATEGORY 5
81/00/00 31 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of a comprehensive analysis for rotorcraft. I - Rotor model and wake analysis

AUTH: A/JOHNSON, W. PAA: A/(NASA, Ames Research Center; U.S. Army, Aeromechanics Laboratory, Moffett Field, CA)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Research and Technology Labs., Moffett Field, Calif.

Vertica, vol. 5, no. 2, 1981, p. 99-129.

MAJS: /*AIRCRAFT DESIGN/*AIRCRAFT WAKES/*ROTARY WINGS/*ROTORCRAFT AIRCRAFT

MINS: / AERODYNAMIC CHARACTERISTICS/ AEROELASTICITY/ AIRCRAFT NOISE/ AIRCRAFT PERFORMANCE/ DESIGN ANALYSIS/ GUST LOADS/ MATHEMATICAL MODELS/ PERFORMANCE PREDICTION/ VIBRATION EFFECTS

ABA: (Author)

ABS: The development of a comprehensive analytical model of rotorcraft aerodynamics and dynamics is described. Particular emphasis is given to describing the reasons behind the choices and decisions involved in constructing the model. The analysis is designed to calculate rotor performance, loads and noise; helicopter vibration and gust response; flight dynamics and handling qualities; and system aeroelastic stability. It is intended for use in the design, testing and evaluation of a wide class of rotors and rotorcraft, and to be the basis for further development of rotary wing theories. The general characteristics of the geometric, structural, inertial, and aerodynamic models used for the rotorcraft components are described, including the assumptions introduced by the chosen models and the resulting capabilities and limitations. Finally, some examples from recent applications of the analysis are given.

81N22055*# ISSUE 13 PAGE 1719 CATEGORY 7 RPT#: NASA-TM-82613 AVRADCOM-TR-81-C-12 81/00/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Component research for future propulsion systems

AUTH: A/WALKER, C. L.; B/WEDEN, G. J.; C/ZUK, J.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.; National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Cleveland, Ohio.

AVAIL.NTIS SAP: HC A02/MF A01

Prepared in cooperation with NASA, Ames Research Center and Army Aviation Research and Development Command, Cleveland, Ohio Presented at Fifty-seventh Specialists' Meeting, Toulouse, 11-14 May 1981; sponsored by AGARD

MAJS: /*COMPRESSORS/*HELICOPTERS/*PROPULSION SYSTEM PERFORMANCE/*TURBINES

MINS: / COMPONENT RELIABILITY/ MARKETING/ RELIABILITY

ABA: S.F.

ABS: Factors affecting the helicopter market are reviewed. The trade-offs involving acquisition cost, mission reliability, and life cycle cost are reviewed, including civil and military aspects. The potential for advanced vehicle configurations with substantial improvements in energy efficiency, operating economics, and characteristics to satisfy the demands of the future market are identified. Advanced propulsion systems required to support these vehicle configurations are discussed, as well as the component technology for the engine systems. Considerations for selection of components in areas of economics and efficiency are presented.

82A26394* ISSUE 11 PAGE 1704 CATEGORY 5
80/10/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of the effect of elastomeric damping material on the stability of a bearingless main rotor system

AUTH: A/SHEFFLER, M.; B/STALEY, J.; C/WARMBRODT, W. PAA: B/(Boeing Vertol Co., Philadelphia, PA); C/(NASA, Ames Research Center, Moffett Field, CA)

CORP: Boeing Vertol Co., Philadelphia, Pa.; National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

American Helicopter Society, National Specialists Meeting on Rotor System Design, Phi[illegible]delphia, PA, Oct. 22-24, 1980. Paper, 9 p.

MAJS: /*BEARINGLESS ROTORS/*ELASTIC DAMPING/*ELASTOMERS/*ROTARY WINGS/*SYSTEMS STABILITY/*VIBRATION DAMPING

MINS: / AEROELASTICITY/ CHORDS (GEOMETRY)/ DIMENSIONS/ FULL SCALE TESTS/ HELICOPTER DESIGN/ PITCH (INCLINATION)/ PROTOTYPES/ ROTOR AERODYNAMICS/ SCALE MODELS/ SYSTEMS ENGINEERING/ WIND TUNNEL TESTS
ABA: G.R.
ABS: The considered investigation was conducted in connection with a contract to design, fabricate, and test a prototype bearingless main rotor (BMR) system. Part of the design process involved an aeroelastic stability investigation in a wind tunnel. Attention is given to a description of model testing, model test results, the description of the full scale wind tunnel configuration, full scale test results, and aspects of correlation with theory. It was found that the complex geometry of the BMR, with 12.5 degrees of nose-up prepitch at the hub and 2.5 degrees of tip-up predroop at the blade attachment clevis, is required to achieve a stable configuration. Subsequent model testing showed that a constrained layer of elastomer material could increase stability at all rotor speeds and collectives tested for a flat strap configuration.

82A26383*# ISSUE 11 PAGE 1708 CATEGORY 8
80/10/00 19 PAGES UNCLASSIFIED DOCUMENT
UTTL: Selection of some rotor parameters to reduce pitch-roll coupling of helicopter flight dynamics
AUTH: A/CHEN, R. T. N. PAA: A/(NASA, Ames Research Center, Moffett Field, CA)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
American Helicopter Society, National Specialists Meeting on Rotor System Design, Philadephia, PA, Oct. 22-24, 1980, Paper. 19 p.
MAJS: /*DECOUPLING/*FLAPPING/*HELICOPTER CONTROL/*PITCH (INCLINATION)/*ROLL/*ROTARY WINGS
MINS: / AERODYNAMIC STABILITY/ AIRCRAFT SAFETY/ FLAPPING HINGES/ HOVERING/ LATERAL CONTROL/ LONGITUDINAL CONTROL
ABA: (Author)
ABS: The results of a study conducted to investigate further a means of choosing primary rotor parameters to reduce the coupling of longitudinal and lateral flapping in hover and in forward flight are presented. The rotor parameters included - flapping hinge offset, flapping hinge restraint, pitch-flap coupling, and blade Lock number - are known to influence the agility, stability, and operational safety of helicopters. Effects of the nonuniform downwash model of White and Blake on the blade flapping motion are examined, and the theoretical calculation is then correlated with experimental test data. The condition for achieving perfect decoupling of the flapping response due to aircraft pitch and roll rates, which was previously obtained for a hovering rotor, is evaluated in forward flight. The results show that negligible coupling is achieved in forward flight; moreover, there is the additional benefit of a slight reduction in the coupling of the roll rate to coning. It is also indicated that the values of the rotor parameters chosen according to the decoupling condition are moderate and that the flapping motion is stable with the parameters chosen.

81A32010* ISSUE 13 PAGE 2107 CATEGORY 5
80/10/00 9 PAGES UNCLASSIFIED DOCUMENT
UTTL: Use of multiblade sensors for on-line rotor tip-path plane estimation
AUTH: A/DU VAL, R. W. PAA: A/(NASA, Ames Research Center, Helicopter Technology Div., Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
American Helicopter Society, Journal, vol. 25, Oct. 1980, p. 13-21.
MAJS: /*FLAPPING/*HELICOPTER CONTROL/*ROTARY WINGS/*ROTOR AERODYNAMICS/*ROTOR BLADES/*TIP SPEED
MINS: / BLADE TIPS/ COMPUTERIZED SIMULATION/ ERROR ANALYSIS/ FILTRATION/ MATRICES (MATHEMATICS)/ NUMERICAL ANALYSIS / PITCH (INCLINATION)/ SENSORS/ TRANSIENT RESPONSE
ABA: (Author)
ABS: Techniques are investigated for on-line estimation of rotor states in the nonrotating frame from multiple, simultaneous measurements in the rotating frame. The multiblade coordinate transformation is first applied to transform both flapping and flapping rate measurements into the nonrotating frame. The 'observer' approach is then used to generate algorithms for estimating tip-path plane rate and attitude from transformed flapping and flapping rate measurements. A numerical evaluation using simulated measurements is conducted to evaluate the performance of the algorithms and recommendations are made.

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80N33356*# ISSUE 24 PAGE 3227 CATEGORY 2 RPT#: NASA-TP-1721 A-8024 80/10/00 32 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Calculation of three-dimensional unsteady transonic flows past helicopter blades
AUTH: A/CHATTOT, J. J.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.
MAJS: /*FINITE DIFFERENCE THEORY/*HELICOPTER DESIGN/*

NUMERICAL ANALYSIS/*ROTOR AERODYNAMICS/*TRANSONIC FLOW
MINS: / ALGORITHMS/ COMPUTER PROGRAMMING/ COMPUTERIZED DESIGN/ DIFFERENCE EQUATIONS
ABA: Author
ABS: A finite difference code for predicting the high speed flow over the advancing helicopter rotor is presented. The code solves the low frequency, transonic small disturbance equation and is suitable for modeling the effects of advancing blade unsteadiness on blades of nearly arbitrary planform. The method employs a quasi-conservative mixed differencing scheme and solves the resulting difference equations by an alternating direction scheme. Computed results showed good agreement with experimental blade pressure data and illustrate some of the effects of varying the rotor planform. The flow unsteadiness is shown to be an indispensible part of a transonic solution. Close to the tip at high advance ratio, cross flow effects can significantly affect the solution.

81N10077*# ISSUE 1 PAGE 12 CATEGORY 8 RPT#: NASA-TM-81188 FAA-RD-80-64 A-8125 80/09/00 393 PAGES UNCLASSIFIED DOCUMENT
UTTL: A piloted simulator investigation of static stability and stability/control augmentation effects on helicopter handling qualities for instrument approach
AUTH: A/LEBACQZ, J. V.; B/FORREST, R. D.; C/GERDES, R. M.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A17/MF A01
MAJS: /*AIRCRAFT RELIABILITY/*FLIGHT SIMULATION/*INSTRUMENT APPROACH/*PITCHING MOMENTS/*ROLLING MOMENTS/*ROTARY WING AIRCRAFT/*YAWING MOMENTS
MINS: / AERODYNAMIC COEFFICIENTS/ HELICOPTERS/ STABILITY DERIVATIVES
ABA: S.F.
ABS: A motion base simulator was used to compare the flying qualities of three generic single rotor helicopters during a full attention to flight control task. Terminal area instrument approaches were flown with and without turbulence. The turbulence of helicopter static stability was investigated in terms of the values of cockpit control gradients as specified in the existing airworthiness criteria. The effectiveness of several types of stability control augmentation systems in improving the instrument flight rules capability of helicopters with reduced static stability was examined. Two levels of static stability in the pitch, roll, and yaw axes were examined for a hingeless rotor configuration; the variations were stable and neutral static stability in pitch and roll, and two levels of stability in yaw. For the lower level of static stability, four types of stability and control augmentation were examined for helicopters with three rotor types: hingeless; articulated, and teetering.

82N10030*# ISSUE 1 PAGE 5 CATEGORY 5 RPT#: NASA-TM-81218 A-8278 80/08/00 372 PAGES UNCLASSIFIED DOCUMENT
UTTL: An investigation of a stoppable helicopter rotor with circulation control --- ames 40 by 80 foot wind tunnel
AUTH: A/BALLARD, J. D.; B/MCCLOUD, J. L., III; C/FORSYTH, T. J.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A16/MF A01
MAJS: /*AERODYNAMIC STABILITY/*CIRCULATION CONTROL ROTORS/*HELICOPTER DESIGN/*LIFT AUGMENTATION/*X WING ROTORS
MINS: / TABLES (DATA)/ WIND TUNNEL TESTS
ABA: J.M.S.
ABS: A stoppable helicopter rotor with circulation control was investigated in the Ames 40 by 80 foot wind tunnel. The model was tested as a rotating wing, a fixed wing, and during transition start/stop sequences. The capability of the model's control system to maintain pitch and roll moment balance during the start/stop sequence, the ability of the blades to withstand the start/stop loads, the adequacy of the control system to maintain balance in the helicopter mode, and the control system capabilities in the fixed-wind mode were assessed. Time-history data of several start/stop sequences of the X-wing rotor, and the steady-state data relating to the model as both a rotor and as a fixed-wing aircraft are presented. In addition, stability data are presented which were acquired during open-loop and closed-loop tests of the hub moment feedback control system.

80N31407*# ISSUE 22 PAGE 2955 CATEGORY 8 RPT#: NASA-TM-81150 A-8158 80/08/00 98 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effects of rotor parameter variations on handling qualities of unaugmented helicopters in simulated terrain flight
AUTH: A/TALBOT, P. D.; B/DUGAN, D. D.; C/CHEN, R. T. N.; D/GERDES, R. M.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A05/MF A01
MAJS: /*FLIGHT SIMULATION/*HELICOPTER CONTROL/*ROTORS
MINS: / MANEUVERABILITY/ PERFORMANCE TESTS
ABA: Author
ABS: A coordinated analysis and ground simulator experiment was performed to investigate the effects on single

rotor helicopter handling qualities of systematic variations in the main rotor hinge restraint, hub hinge offset, pitch-flap coupling, and blade lock number. Teetering rotor, articulated rotor, and hingeless rotor helicopters were evaluated by research pilots in special low level flying tasks involving obstacle avoidance at 60 to 100 knots airspeed. The results of the experiment are in the form of pilot ratings, pilot commentary, and some objective performance measures. Criteria for damping and sensitivity are reexamined when combined with the additional factors of cross coupling due to pitch and roll rates, pitch coupling with collective pitch, and longitudinal static stability. Ratings obtained with and without motion are compared. Acceptable flying qualities were obtained within each rotor type by suitable adjustment of the hub parameters, however, pure teetering rotors were found to lack control power for the tasks. A limit for the coupling parameter L sub q/L sub p of 0.35 is suggested.

80N33349*# ISSUE 24 PAGE 3226 CATEGORY 2 RPT#: NASA-TM-81213 AVRADCOM-TR-80-A-11 A-8239 80/07/00 27 PAGES UNCLASSIFIED DOCUMENT

UTTL: Comparison of calculated and measured helicopter rotor lateral flapping angles

AUTH: A/JOHNSON, W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, St. Louis, Mo. AVAIL.NTIS SAP: HC A03/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.

MAJS: /*FLAPPING/*HELICOPTER PERFORMANCE/*ROTARY WINGS

MINS: / AIRCRAFT WAKES/ GLIDING/ WIND TUNNEL TESTS

ABA: Author

ABS: Calculated and measured values of helicopter rotor flapping angles in forward flight are compared for a model rotor in a wind tunnel and an autogiro in gliding flight. The lateral flapping angles can be accurately predicted when a calculation of the nonuniform wake-induced velocity is used. At low advance ratios, it is also necessary to use a free wake geometry calculation. For the cases considered, the tip vortices in the rotor wake remain very close to the tip-path plane, so the calculated values of the flapping motion are sensitive to the fine details of the wake structure, specifically the viscous core radius of the tip vortices.

80N28371*# ISSUE 19 PAGE 2524 CATEGORY 8 RPT#: NASA-TM-81203 AVRADCOM-TM-80-A-02 A-8194 80/07/00 51 PAGES UNCLASSIFIED DOCUMENT

UTTL: A mathematical representation of an advanced helicopter for piloted simulator investigations of control system and display variations

AUTH: A/AIKEN, E. W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*DISPLAY DEVICES/*HELICOPTER CONTROL/*HELICOPTERS/* MATHEMATICAL MODELS

MINS: / COMPUTERIZED SIMULATION/ CONTROLLABILITY/ HELICOPTER DESIGN/ HELICOPTER PERFORMANCE

ABA: L.F.M.

ABS: A mathematical model of an advanced helicopter is described. The model is suitable for use in control/display research involving piloted simulation. The general design approach for the six degree of freedom equations of motion is to use the full set of nonlinear gravitational and inertial terms of the equations and to express the aerodynamic forces and moments as the reference values and first order terms of a Taylor series expansion about a reference trajectory defined as a function of longitudinal airspeed. Provisions for several different specific and generic flight control systems are included in the model. The logic required to drive various flight control and weapon delivery symbols on a pilot's electronic display is also provided. Finally, the model includes a simplified representation of low altitude wind and turbulence effects. This model was used in a piloted simulator investigation of the effects of control system and display variations for an attack helicopter mission.

80N28341*# ISSUE 19 PAGE 2520 CATEGORY 5 RPT#: NASA-TM-81217 A-8263 80/07/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: A pilot's assessment of helicopter handling-quality factors common to both agility and instrument flying tasks

AUTH: A/GERDES, R. M.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*ATTITUDE CONTROL/*FLIGHT SIMULATION/*HELICOPTER CONTROL/*HELICOPTERS/*NAP-OF-THE-EARTH NAVIGATION

MINS: / AIRCRAFT CONTROL/ AUGMENTATION/ CONTROLLABILITY/ HELICOPTER PERFORMANCE/ INSTRUMENT FLIGHT RULES/ MANEUVERABILITY

ABA: L.F.M.

ABS: A series of simulation and flight investigations were

undertaken to evaluate helicopter flying qualities and the effects of control system augmentation for nap-of-the-Earth (NOE) agility and instrument flying tasks. Handling quality factors common to both tasks were identified. Precise attitude control was determined to be a key requirement for successful accomplishment of both tasks. Factors that degraded attitude controllability were improper levels of control sensitivity and damping, and rotor system cross coupling due to helicopter angular rate and collective pitch input. Application of rate command, attitude command, and control input decouple augmentation schemes enhanced attitude control and significantly improved handling qualities for both tasks. The NOE agility and instrument flying handling quality considerations, pilot rating philosophy, and supplemental flight evaluations are also discussed.

80N28297*# ISSUE 19 PAGE 2513 CATEGORY 1 RPT#: NASA-TM-81183 AVRADCOM-TR-80-A-6-PT-2 A-8101 80/07/00 2 VOLS 97 PAGES UNCLASSIFIED DOCUMENT

UTTL: A comprehensive analytical model of rotorcraft aerodynamics and dynamics. Part 2: User's manual

AUTH: A/JOHNSON, W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A05/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.

MAJS: /*AERODYNAMIC BALANCE/*COMPUTER PROGRAMS/*FLIGHT CHARACTERISTICS/*FLUTTER ANALYSIS/*LOADS (FORCES)/* ROTOR AERODYNAMICS/*USER MANUALS (COMPUTER PROGRAMS)/* VELOCITY MEASUREMENT

MINS: / AIRFRAMES/ CONVERGENCE/ DATA PROCESSING/ EQUATIONS OF MOTION/ HARMONICS/ HELICOPTERS

ABA: E.D.K.

ABS: The use of a computer program for a comprehensive analytical model of rotorcraft aerodynamics and dynamics is described. The program calculates the loads and motion of helicopter rotors and airframe. First the trim solution is obtained, then the flutter, flight dynamics, and/or transient behavior can be calculated. Either a new job can be initiated or further calculations can be performed for an old job.

80A42003* ISSUE 17 PAGE 3237 CATEGORY 52 CNT#: NCC2-35 80/06/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Thresholds for detection of constant rotary acceleration during vibratory rotary acceleration

AUTH: A/CLARK, B.; B/STEWART, J. D.; C/PHILLIPS, N. H.
PAA: C/(NASA. Ames Research Center, Moffett Field; San Jose State University, San Jose, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; San Jose State Univ., Calif.
Aviation, Space, and Environmental Medicine, vol. 51, June 1980, p. 603-606.

MAJS: /*AIRCRAFT PILOTS/*ANGULAR ACCELERATION/*FLIGHT SIMULATORS/*ROTATION/*THRESHOLDS (PERCEPTION)/* VIBRATION EFFECTS

MINS: / ACCELERATION STRESSES (PHYSIOLOGY)/ ANALYSIS OF VARIANCE/ DARKNESS/ HELICOPTERS/ VERTICAL MOTION SIMULATORS/ VISUAL PERCEPTION

ABA: (Author)

ABS: The effects of vibratory angular acceleration on detection thresholds for constant angular acceleration in a dynamic flight simulator are reported in three experiments. Detection thresholds were determined for 10 pilots and four nonpilots using a random, double-staircase procedure while the subjects sat erect in a device which rotated about an earth-vertical axis. Constant angular acceleration were presented for 0.5 and 1.0 s with concurrent, vibratory angular acceleration at 1 and 5 Hz, and thresholds with no vibratory angular acceleration were established. The thresholds were obtained while the subjects observed a visual reference in the enclosed cockpit in two experiments and in total darkness in a third. The results confirmed earlier experiments showing an inverse relationship between the duration of constant angular acceleration and detection threshold and showed that the detection thresholds in darkness were higher than with a visual reference present. Two analyses of variance revealed no significant differences in thresholds across the three vibration conditions. These results indicate that vibratory angular acceleration of fairly high levels can be present in a dynamic flight simulator without masking the pilot's ability to detect either maneuver or disturbance motions.

80N28298*# ISSUE 19 PAGE 2513 CATEGORY 1 RPT#: NASA-TM-81184 AVRADCOM-TR-80-A-7 A-8102 80/06/00 155 PAGES UNCLASSIFIED DOCUMENT

UTTL: A comprehensive analytical model of rotorcraft aerodynamics and dynamics. Part 3: Program manual

AUTH: A/JOHNSON, W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, St. Louis, Mo. AVAIL.NTIS SAP: HC A08/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.

MAJS: /*AERODYNAMIC LOADS/*AIRCRAFT NOISE/*COMPUTER PROGRAMS

/*HELICOPTER CONTROL/*HELICOPTER PERFORMANCE/*ROTOR AERODYNAMICS/*VIBRATION
MINS: / COMPUTERIZED SIMULATION/ ROTARY WING AIRCRAFT
ABA: Author
ABS: The computer program for a comprehensive analytical model of rotorcraft aerodynamics and dynamics is described. This analysis is designed to calculate rotor performance, loads, and noise; the helicopter vibration and gust response; the flight dynamics and handling qualities; and the system aeroelastic stability. The analysis is a combination of structural, inertial, and aerodynamic models that is applicable to a wide range of problems and a wide class of vehicles. The analysis is intended for use in the design, testing, and evaluation of rotors and rotorcraft and to be a basis for further development of rotary wing theories.

80N28296*# ISSUE 19 PAGE 2513 CATEGORY 1 RPT#: NASA-TM-81182 AVRADCOM-TR-80-A-5-PT-1 A-8100 80/06/00 2 VOLS 442 PAGES UNCLASSIFIED DOCUMENT
UTTL: A comprehensive analytical model of rotorcraft aerodynamics and dynamics. Part 1: Analysis development
AUTH: A/JOHNSON, W.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A19/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.
MAJS: /*AEROELASTICITY/*DYNAMIC STRUCTURAL ANALYSIS/*HELICOPTERS/*MATHEMATICAL MODELS/*ROTARY WINGS/*ROTOR AERODYNAMICS
MINS: / CONTROLLABILITY/ DIGITAL COMPUTERS/ EQUATIONS OF MOTION/ INERTIA/ LINEAR SYSTEMS
ABA: A.R.H.
ABS: Structural, inertia, and aerodynamic models were combined to form a comprehensive model of rotor aerodynamics and dynamics that is applicable to a wide range of problems and a wide class of vehicles. A digital computer program is used to calculate rotor performance, loads, and noise; helicopter vibration and gust response; flight dynamics and handling qualities; and system aeroelastic stability. The analysis is intended for use in the design, testing, and evaluation of rotors and rotorcraft, and to be a basis for further development of rotary wing theories.

80A49703* ISSUE 22 PAGE 4022 CATEGORY 5 RPT#: SAE PAPER 800755 80/00/00 35 PAGES UNCLASSIFIED DOCUMENT
UTTL: The future of short-haul transport aircraft
AUTH: A/WILLIAMS, L. J. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
Society of Automotive Engineers, International Air Transportation Meeting, Cincinnati, Ohio, May 20-22, 1980. 35 p.
MAJS: /*PASSENGER AIRCRAFT/*RESEARCH AND DEVELOPMENT/*SHORT HAUL AIRCRAFT/*SYSTEM EFFECTIVENESS/*TECHNOLOGY UTILIZATION/*TRANSPORT AIRCRAFT
MINS: / AIR TRANSPORTATION/ AIRCRAFT DESIGN/ AIRCRAFT FUELS/ COST REDUCTION/ ECONOMIC FACTORS/ HELICOPTERS/ REGULATIONS/ TURBOPROP AIRCRAFT
ABA: V.P.
ABS: Owing to recent economic and regulatory changes and escalating fuel costs, major airlines have begun to shift their short-haul service to longer, more profitable routes, leaving short-haul operations to rapidly growing commuter airlines. The short-haul routes are currently serviced by small turboprop-powered aircraft. The results of some recent design studies aimed at replacing the turboprops with specialized propeller- and rotor-driven aircraft are discussed. Some potential future designs are illustrated and discussed.

80N24294*# ISSUE 15 PAGE 1936 CATEGORY 5 RPT#: NASA-TM-81177 AVRADCOM-TR-80-A-3 A-8089 80/04/00 133 PAGES UNCLASSIFIED DOCUMENT
UTTL: Wind-tunnel tests of the XV-15 tilt rotor aircraft
AUTH: A/WEISBERG, J. A.; B/MAISEL, M. D.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Research and Technology Labs., Moffett Field, Calif. AVAIL.NTIS SAP: HC A07/MF A01
Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif.
MAJS: /*AERODYNAMIC CHARACTERISTICS/*AEROELASTICITY/*AIRCRAFT PERFORMANCE/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS/*XV-15 AIRCRAFT
MINS: / AERODYNAMIC CONFIGURATIONS/ DATA REDUCTION/ DYNAMIC STRUCTURAL ANALYSIS/ TABLES (DATA)
ABA: Author
ABS: The XV-15 aircraft was tested in the Ames 40 by 80 Foot Wind Tunnel for preliminary evaluation of aerodynamic and aeroelastic characteristics prior to flight. The tests were undertaken to investigate the aircraft performance, stability, control and structural loads for flight modes from helicopter

through transition and airplane mode up to the tunnel capability of 170 knots. Results from these tests are presented.

80N24262*# ISSUE 15 PAGE 1931 CATEGORY 2 RPT#: NASA-TM-81189 AVRADCOM-TR-80-A-4 A-8149 80/04/00 34 PAGES UNCLASSIFIED DOCUMENT

UTTL: Comparison of calculated and measured model rotor loading and wake geometry

AUTH: A/JOHNSON, W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Research and Technology Labs., Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01
Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif.

MAJS: /*HELICOPTER WAKES/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / BLADE TIPS/ FLOW DISTRIBUTION/ HELICOPTER PERFORMANCE/ VORTICES

ABA: Author

ABS: The calculated blade bound circulation and wake geometry are compared with measured results for a model helicopter rotor in hover and forward flight. Hover results are presented for rectangular tip and ogee tip planform blades. The correlation is quite good when the measured wake geometry characteristics are used in the analysis. Available prescribed wake geometry models are found to give fair predictions of the loading, but they do not produce a reasonable prediction of the induced power. Forward flight results are presented for twisted and untwisted blades. Fair correlation between measurements and calculations is found for the bound circulation distribution on the advancing side. The tip vortex geometry in the vicinity of the advancing blade in forward flight was predicted well by the free wake calculation used, although the wake geometry did not have a significant influence on the calculated loading and performance for the cases considered.

80N21287*# ISSUE 12 PAGE 1515 CATEGORY 2 RPT#: NASA-TM-78622 AVRADCOM-TR-79-44 A-7956 80/03/00 131 PAGES UNCLASSIFIED DOCUMENT

UTTL: An experimental evaluation of a helicopter rotor section designed by numerical optimization

AUTH: A/HICKS, R. M.; B/MCCROSKEY, W. J. PAA: B/(Army Aviation Res. and Development Command, St. Louis, Mo.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /*COMPUTERIZED DESIGN/*HELICOPTER DESIGN/*ROTARY WINGS

MINS: / AERODYNAMIC DRAG/ LIFT/ MACH NUMBER/ PITCHING MOMENTS/ PRESSURE DISTRIBUTION/ TRANSONIC WIND TUNNELS / WIND TUNNEL TESTS

ABA: M.G.

ABS: The wind tunnel performance of a 10-percent thick helicopter rotor section design by numerical optimization is presented. The model was tested at Mach number from 0.2 to 0.84 with Reynolds number ranging from 1,900,000 at Mach 0.2 to 4,000,000 at Mach numbers above 0.5. The airfoil section exhibited maximum lift coefficients greater than 1.3 at Mach numbers below 0.45 and a drag divergence Mach number of 0.82 for lift coefficients near 0. A moderate 'drag creep' is observed at low lift coefficients for Mach numbers greater than 0.6.

80N15138*# ISSUE 6 PAGE 703 CATEGORY 8 RPT#: NASA-TP-1431 A-7777 80/01/00 63 PAGES UNCLASSIFIED DOCUMENT

UTTL: Effects of primary rotor parameters on flapping dynamics

AUTH: A/CHEN, R. T. N.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*FLAPPING HINGES/*HELICOPTER PERFORMANCE/*RIGID ROTORS/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / AERODYNAMIC STABILITY/ DYNAMIC RESPONSE/ EQUATIONS OF MOTION/ FLIGHT CHARACTERISTICS

ABA: J.M.S.

ABS: The effects of flapping dynamics of four main rotor design features that influence the agility, stability, and operational safety of helicopters are studied. The parameters include flapping hinge offset, flapping hinge restraint, pitch-flap coupling, and blade lock number. First, the flapping equations of motion are derived that explicitly contain the design parameters. The dynamic equations are then developed for the tip-path plane, and the influence of individual and combined variations in the design parameters determined. The steady state flapping response is examined with respect to control input and aircraft angular rate which leads to a feedforward control law for control decoupling through cross feed, and a feedback control law to decouple the steady state flapping response. The condition for achieving perfect decoupling of the flapping response due to aircraft pitch and roll rates without using feedback control is also found for the hover case. It is indicated that the frequency of the regressing flapping mode of the rotor system can become low enough to require consideration in the assessment of handling characteristics.

81A41823* ISSUE 19 PAGE 3262 CATEGORY 5
80/00/00 1110 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter theory --- Book
AUTH: A/JOHNSON, W.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Department of the Army, Washington, D. C. SAP: $95 Princeton, N.J. Princeton University Press, 1980. 1110 p.
MAJS: /*AERODYNAMIC CHARACTERISTICS/*FLIGHT MECHANICS/* HELICOPTER DESIGN/*HELICOPTER PERFORMANCE/*ROTARY WINGS/*ROTOR AERODYNAMICS
MINS: / AERODYNAMIC STABILITY/ AERODYNAMIC STALLING/ AIRCRAFT NOISE/ AIRCRAFT STABILITY/ BIBLIOGRAPHIES/ FOURIER ANALYSIS/ HELICOPTER CONTROL/ VERTICAL FLIGHT/ VORTICES
ABA: O.C.
ABS: A comprehensive presentation is made of the engineering analysis methods used in the design, development and evaluation of helicopters. After an introduction covering the fundamentals of helicopter rotors, configuration and operation, rotary wing history, and the analytical notation used in the text, the following topics are discussed: (1) vertical flight, including momentum, blade element and vortex theories, induced power, vertical drag and ground effect; (2) forward flight, including in addition to momentum and vortex theory for this mode such phenomena as rotor flapping and its higher harmonics, tip loss and root cutout, compressibility and pitch-flap coupling; (3) hover and forward flight performance assessment; (4) helicopter rotor design; (5) rotary wing aerodynamics; (6) rotary wing structural dynamics, including flutter, flap-lag dynamics ground resonance and vibration and loads; (7) helicopter aeroelasticity; (8) stability and control (flying qualities); (9) stall; and (10) noise.

81A40180*# ISSUE 18 PAGE 3076 CATEGORY 5 RPT#: AHS 80-55 80/00/00 22 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/FAA flight-test investigation of helicopter microwave landing system approaches
AUTH: A/PEACH, I. L., JR.; B/BULL, J. S.; C/ANDERSON, D. J.; D/DUGAN, D. C.; E/ROSS, V. L.; F/HUNTING, A. W.; G/PATE, D. P.; H/SAVAGE, J. C. PAA: E/(NASA, Ames Research Center, Moffett Field, CA); H/(FAA, Flight Standards National Field Office, Oklahoma City, OK)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Federal Aviation Administration, Oklahoma City, Okla. In: American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings. (A81-40136 18-01) Washington, DC, American Helicopter Society, 1980, 22 p.
MAJS: /*FLIGHT TESTS/*GLIDE PATHS/*HELICOPTER CONTROL/* INSTRUMENT APPROACH/*MICROWAVE LANDING SYSTEMS/* PERFORMANCE TESTS
MINS: / DATA ACQUISITION/ SYSTEMS ENGINEERING/ TRACKING (POSITION)
ABA: K.S.
ABS: The helicopter Microwave Landing System flight-test investigations, conducted by a joint NASA/FAA effort in order to gather statistical data for establishing terminal instrument procedures criteria, and to provide a performance data base for developing advanced MLS guidance concepts, are presented. The specific flight-test objectives were to: (1) develop acceptable angle-only MLS approach profiles; (2) determine tracking errors; (3) determine altitude loss during missed approach; (4) evaluate guidance display sensitivities; and (5) evaluate pilot acceptability. Fourteen pilots flew 140 manual (without stability augmentation) dual-pilot simulated instrument approaches in a UH-1H helicopter. The flight profiles flown included 3-, 6-, and 9-degree glideslope, centerline approaches to decision heights of 50, 100, and 150 ft, respectively. The angular guidance display sensitivities and the data acquisition system are also described. Eight major conclusions are made, and include the following: (1) the use of pitch attitude to control airspeed and collective to control glideslope was the preferred pilot technique for the steep glideslope approaches, and (2) angular guidance deviation indicator sensitivity requirements for helicopter MLS approaches to STOLports and heliports have been found to be significantly different from standard ILS sensitivities.

81A40160*# ISSUE 18 PAGE 3085 CATEGORY 8 RPT#: AHS 80-30 80/00/00 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: A piloted simulator investigation of static stability and stability/control augmentation effects on helicopter handling qualities for instrument approach
AUTH: A/LEBACQZ, J. V.; B/FORREST, R. D. PAA: A/(NASA, Ames Research Center, Moffett Field, CA); B/(FAA, Moffett Field, CA)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Federal Aviation Administration, Moffett Field, Calif. In: American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings. (A81-40136 18-01) Washington, DC, American Helicopter Society, 1980, 23 p.
MAJS: /*AIRCRAFT PILOTS/*CONTROL STABILITY/*FLIGHT SIMULATORS/*HELICOPTER CONTROL/*INSTRUMENT APPROACH/*

STATIC STABILITY .

MINS: / AIRCRAFT CONFIGURATIONS/ FLIGHT CONDITIONS/ MATHEMATICAL MODELS/ TURBULENCE EFFECTS/ VERY HIGH FREQUENCIES

ABA: (Author)

ABS: A ground simulator experiment was conducted on the Flight Simulator for Advanced Aircraft at Ames Research Center to investigate the influence of several static stability and stability/control augmentation design parameters on helicopter flying qualities during terminal area operations in instrument conditions. Effects of light turbulence were included. Two levels of static stability in each rotational axis (pitch, roll, yaw) were examined for a hingeless rotor configuration. The variations in pitch and roll were: (1) stable and (2) neutral static stability; in yaw there were two stable levels. Four types of stability/control augmentation were also examined for the lower level of static stability in each axis. This latter investigation covered three helicopter rotor types: hingeless, articulated, and teetering. Four pilots performed a total of 105 evaluations of these parameters for a representative VOR instrument approach task. Pilot rating results indicate the acceptability of neutral static stability longitudinally and laterally and the need for pitch-roll attitude augmentation to achieve a satisfactory system.

81A40147*# ISSUE 18 PAGE 3071 CATEGORY 4 RPT#: AHS 80-16 80/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Navigation errors encountered using weather-mapping radar for helicopter IFR guidance to oil rigs

AUTH: A/PHILLIPS, J. D.; B/BULL, J. S.; C/HEGARTY, D. M.; D/DUGAN, D. C. PAA: D/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

In: American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings. (A81-40136 18-01) Washington, DC, American Helicopter Society, 1980. 10 p.

MAJS: /*FLIGHT TESTS/*HELICOPTER CONTROL/*INSTRUMENT ERRORS/*INSTRUMENT FLIGHT RULES/*METEOROLOGICAL RADAR/*NAVIGATION INSTRUMENTS/*OIL EXPLORATION

MINS: / AIRCRAFT GUIDANCE/ OFFSHORE ENERGY SOURCES/ PILOT TRAINING/ POSITION ERRORS/ RADAR RANGE/ RANGE ERRORS

ABA: (Author)

ABS: In 1978 a joint NASA-FAA helicopter flight test was conducted to examine the use of weather-mapping radar for IFR guidance during landing approaches to oil rig heilpads. The following navigation errors were measured: total system error, radar-range error, radar-bearing error, and flight technical error. Three problem areas were identified: (1) operational problems leading to pilot blunders, (2) poor navigation to the downwind final approach point, and (3) pure homing on final approach. Analysis of these problem areas suggests improvement in the radar equipment, approach procedure, and pilot training, and gives valuable insight into the development of future navigation aids to serve the off-shore oil industry.

81A40137*# ISSUE 18 PAGE 3064 CATEGORY 2 RPT#: AHS 80-2 80/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Computerized three-dimensional aerodynamic design of a lifting rotor blade

AUTH: A/TAUBER, M. E.; B/HICKS, R. M. PAA: B/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

In: American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings. (A81-40136 18-01) Washington, DC, American Helicopter Society, 1980. 12 p.

MAJS: /*COMPUTERIZED DESIGN/*HELICOPTER DESIGN/*LIFTING ROTORS/*ROTOR AERODYNAMICS/*ROTOR BLADES (TURBOMACHINERY)

MINS: / AIRFOIL PROFILES/ HELICOPTER PERFORMANCE/ LEADING EDGES/ PRESSURE DISTRIBUTION/ SHAPES

ABA: (Author)

ABS: A three-dimensional, inviscid, full-potential lifting rotor code was used to demonstrate that pressure distributions on both advancing and retreating blades could be significantly improved by perturbing local airfoil sections. The perturbations were described by simple geometric shape functions. To illustrate the procedure, an example calculation was made at a forward flight speed of 85 m/sec (165 knots) and an advance ratio of 0.385. It was found that a minimum of three shape functions was required to improve the pressures without producing undesirable secondary effects in high-speed forward flight on a hypothetical modern rotor blade initially having an NLR-1 supercritical airfoil. Reductions in the shock strength on the advancing blade could be achieved, while simultaneously lessening leading-edge pressure gradients on the retreating blade. The major blade section modifications required were blunting of the upper surface leading edge and some reshaping of the blade's upper surface resulting in moderately thicker airfoils.

81A40125* ISSUE 18 PAGE 3084 CATEGORY 8
80/00/00 25 PAGES UNCLASSIFIED DOCUMENT

UTTL: Identification of a linear model of rotor-fuselage dynamics from nonlinear simulation data

AUTH: A/DUVAL, R. W.; B/MACKIE, D. B. PAA: B/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

In: European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers. Part 2. (A81-40076 18-01) Bristol, University of Bristol, 1980. 25 p.

MAJS: /*AIRCRAFT MODELS/*AIRCRAFT STABILITY/*FUSELAGES/*ROTARY WING AIRCRAFT/*ROTOR AERODYNAMICS

MINS: / DEGREES OF FREEDOM/ HOVERING STABILITY/ LINEAR EQUATIONS/ REGRESSION ANALYSIS

ABA: (Author)

ABS: Linear regression techniques are used to obtain 9- and 12-degree-of-freedom linear rotorcraft models from the input-output data generated by a nonlinear, blade-element rotorcraft simulation in hover. The resulting models are used to evaluate the coupling of the fuselage modes with the rotor flapping and lead-lag modes at various frequencies. New techniques are proposed and evaluated to improve the identification process, including a method of verifying the assumed model structure by using data sets generated at different input frequencies.

81A40120* ISSUE 18 PAGE 3084 CATEGORY 8
80/00/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: A pilot's assessment of helicopter handling-quality factors common to both agility and instrument flying tasks

AUTH: A/GERDES, R. M. PAA: A/(NASA, Ames Research Center, Moffett Field, CA)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

In: European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers. Part 2. (A81-40076 18-01) Bristol, University of Bristol, 1980. 18 p.

MAJS: /*CONTROLLABILITY/*FLIGHT CONTROL/*HELICOPTER CONTROL/*MANUAL CONTROL/*NAP-OF-THE-EARTH NAVIGATION/*PILOT PERFORMANCE

MINS: / AERODYNAMIC STABILITY/ ATTITUDE CONTROL/ FLIGHT CHARACTERISTICS/ FLIGHT SIMULATION/ HELICOPTER PERFORMANCE/ HELICOPTER PROPELLER DRIVE/ INSTRUMENT FLIGHT RULES/ MANEUVERABILITY/ MILITARY HELICOPTERS/ ROTARY WINGS

ABA: (Author)

ABS: Results from a series of simulation and flight investigations undertaken to evaluate helicopter flying qualities and the effects of control system augmentation for nap-of-the-earth (NOE) agility and instrument flying tasks were analyzed to assess handling-quality factors common to both tasks. Precise attitude control was determined to be a key requirement for successful accomplishment of both tasks. Factors that degraded attitude controllability were improper levels of control sensitivity and damping and rotor-system cross-coupling due to helicopter angular rate and collective pitch input. Application of rate-command, attitude-command, and control-input decouple augmentation schemes enhanced attitude control and significantly improved handling qualities for both tasks. NOE agility and instrument flying handling-quality considerations, pilot rating philosophy, and supplemental flight evaluations are also discussed.

81A16588* ISSUE 5 PAGE 652 CATEGORY 5 80/00/00
18 PAGES UNCLASSIFIED DOCUMENT

UTTL: The XV-15 tilt rotor research aircraft

AUTH: A/DUGAN, D. C.; B/ERHART, R. G.; C/SCHROERS, L. G. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.); B/(Bell Helicopter Textron, Fort Worth, Tex.); C/(U.S. Army, Aeromechanics Laboratory, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Textron Bell Helicopter, Fort Worth, Tex.; Army Research and Technology Labs., Moffett Field, Calif.

(Society of Experimental Test Pilots, Symposium, 24th, Beverly Hills, Calif., Sept. 24-27, 1980.) Society of Experimental Test Pilots, Technical Review, vol. 15, no. 2, 1980, p. 168-185.

MAJS: /*HELICOPTER PERFORMANCE/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*XV-15 AIRCRAFT

MINS: / FLIGHT CHARACTERISTICS/ PILOT PERFORMANCE

ABA: A.T.

ABS: The XV-15 tilt rotor has shown good handling qualities in all modes of flight; in the helicopter mode it allows precision hover and agility with low pilot workload. Vibration and noise levels are low; the conversion procedure is easy, with satisfactory acceleration or deceleration. The XV-15 handling demonstrated its potential for many civil and military applications.

80A45556*# ISSUE 19 PAGE 3454 CATEGORY 5 RPT#: AIAA 80-1778 80/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: A new approach to active control of rotorcraft vibration

AUTH: A/GUPTA, N. K.; B/DU VAL, R. W.; C/FULLER, J. PAA: A/(Integrated Systems, Inc., Stanford, Calif.); B/(NASA, Ames Research Center, Moffett Field, Calif.); C/(Systems Control, Inc., Palo Alto, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Systems Control, Inc., Palo Alto, Calif.

In: Guidance and Control Conference, Danvers, Mass., August 11-13, 1980, Collection of Technical Papers. (A80-45514 19-17) New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 347-358.

MAJS: /*ACCELERATION PROTECTION/*AIRCRAFT CONTROL/*FEEDBACK CONTROL/*ROTORCRAFT AIRCRAFT/*STRUCTURAL VIBRATION/*VIBRATION DAMPING

MINS: / AIRCRAFT DESIGN/ DEGREES OF FREEDOM/ FLIGHT SIMULATION/ FUSELAGES/ PHASE SHIFT/ RESONANT FREQUENCIES/ STATE VECTORS

ABA: (Author)

ABS: A state-variable feedback approach is utilized for active control of rotorcraft vibration. Fuselage accelerations are passed through undamped second-order filters with resonant frequencies at N/rev. The resulting outputs contain predominantly the N/rev vibration components, phase shifted by 180 deg, and are used to drive the blade pitch to cancel this component of fuselage vibration. The linear-quadratic-gaussian (LQG) method is used to design a feedback control system utilizing these filtered accelerations. The design is based on a nine-degree-of-freedom linear model of the Rotor System Research Aircraft (RSRA) in hover and is evaluated on a nonlinear blade-element simulation of the RSRA for this flight condition. The system is shown to essentially eliminate vibrations at N/rev in all axes. The required blade-pitch amplitude is within the capability of conventional actuators at the N/rev frequency.

80A34998*# ISSUE 14 PAGE 2498 CATEGORY 8 RPT#: AIAA 80-0673 AHS PAPER 80-72 80/00/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Multicyclic control of a helicopter rotor considering the influence of vibration, loads, and control motion

AUTH: A/BROWN, T. J.; B/MCCLOUD, J. L., III PAA: B/(NASA, Ames Research Center, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

In: Structures, Structural Dynamics, and Materials Conference, 21st, Seattle, Wash., May 12-14, 1980, Technical Papers. Part 1. (A80-34993 14-39) New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 82-100.

MAJS: /*AERODYNAMIC LOADS/*HELICOPTER CONTROL/*LOAD DISTRIBUTION (FORCES)/*ROTARY WINGS/*ROTOR AERODYNAMICS/*VIBRATION EFFECTS

MINS: / DATA BASES/ FEEDBACK CONTROL/ HELICOPTER TAIL ROTORS / LINEAR EQUATIONS/ MOTION STABILITY/ OPTIMAL CONTROL/ REGRESSION ANALYSIS/ TRANSFER FUNCTIONS

ABA: (Author)

ABS: Weighted multiple linear regression is used to establish a transfer function matrix relationship between higher harmonic control inputs and transducer vibration outputs for a controllable twist rotor. Data used in the regression were taken from the test of a KAMAN controllable twist rotor conducted in the Ames Research Center's 40- by 80-Foot Wind Tunnel in June 1977. Optimal controls to minimize fixed system vibrational levels are calculated using linear quadratic regulatory theory with a control deflection penalty included in the performance criteria. Control sensitivity to changes in control travel, forward speed, and lift and propulsive forces is examined. It is found that the linear transfer matrix is a strong function of forward speed and a weak function of lift and propulsive force. An open-loop strategy is proposed for systems with limited control travel.

80A34997*# ISSUE 14 PAGE 2497 CATEGORY 8 RPT#: AIAA 80-0671 AHS PAPER 80-70 80/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Multicyclic control for helicopters - Research in progress at Ames Research Center

AUTH: A/MCCLOUD, J. L., III PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

In: Structures, Structural Dynamics, and Materials Conference, 21st, Seattle, Wash., May 12-14, 1980, Technical Papers. Part 1. (A80-34993 14-39) New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 77-81.

MAJS: /*HELICOPTER CONTROL/*HELICOPTER TAIL ROTORS/*ROTARY WINGS/*STRUCTURAL VIBRATION

MINS: / BENDING MOMENTS/ FEEDBACK CONTROL/ GUST ALLEVIATORS/ PITCHING MOMENTS/ STRUCTURAL STABILITY

ABA: (Author)

ABS: The term multicyclic control describes a blade pitch control technique used by helicopter designers to alleviate vibration in rotorcraft. Because rotor-induced vibrations are periodic, a multicyclic system, synchronized to the main rotor's azimuth

position, is suitable. Many types of rotors - ranging from the jet-flap and circulation-control rotors to the conventional full-blade feathering rotors - have utilized multicyclic control. Multicyclic control systems may be designed to reduce blade-bending stresses, to reduce rotor-induced vibration, and to improve rotor performance. Rotor types are reviewed, primarily to highlight their differences. The increased use of composites in blade construction is seen to indicate that vibration alleviation will be the prime focus of multicyclic control. Adaptive feedback control systems, which also incorporate gust alleviation, are considered to be the ultimate application of multicyclic control.

80A33123* ISSUE 13 PAGE 2294 CATEGORY 5
80/00/00 13 PAGES UNCLASSIFIED DOCUMENT
UTTL: The promise of multicyclic control --- for helicopter vibration reduction
AUTH: A/MCCLOUD, J. L., III PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
Vertica, vol. 4, no. 1, 1980, p. 29-41.
MAJS: /*DYNAMIC CONTROL/*HELICOPTER CONTROL/*ROTARY WINGS/*VIBRATION DAMPING/*WING OSCILLATIONS
MINS: / ENERGY ABSORPTION/ FEEDBACK CONTROL/ FLOW DISTRIBUTION/ INPUT/OUTPUT ROUTINES/ JET FLAPS/ RIDING QUALITY/ VARIABLE PITCH PROPELLERS
ABA: (Author)
ABS: The rough ride a helicopter endures is known to be self-generated. This roughness results in fatiguing blade loads and vibration which can be eliminated or greatly reduced by multicyclic control. Rotor performance may also be improved. Several types of rotors which have employed multicyclic control are reviewed and compared. Their differences are highlighted and their potential advantages and disadvantages are discussed. The flow field these rotors must operate in is discussed, and it is shown that simultaneous elimination of vibration and oscillatory blade loads is not an inherent solution to the roughness problem. The use of rotor blades and energy absorbers is proposed. Input-output relations are considered and a gain control for ROMULAN, a multicyclic controlling computer program, is introduced. Implications of the introduction of multicyclic systems into helicopters are also discussed.

82N23243*# ISSUE 14 PAGE 1903 CATEGORY 5 RPT#: NASA-TM-84705 NAS 1.15:84705 80/00/00 57 PAGES UNCLASSIFIED DOCUMENT
UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshop. Volume 7: Tilt Rotor Session
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A03/MF A01
Workshop held at Palo Alto, Calif., 2-5 Dec. 1980
MAJS: /*AIRCRAFT CONTROL/*AIRCRAFT DESIGN/*AIRCRAFT PERFORMANCE/*GUST LOADS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*XV-15 AIRCRAFT
MINS: / AIR TRAFFIC CONTROL/ AIRCRAFT CARRIERS/ AIRCRAFT NOISE/ CIVIL AVIATION/ RESCUE OPERATIONS/ STRUCTURAL DESIGN CRITERIA
ABA: S.L.
ABS: The technical characteristics of the XV-15 aircraft were discussed. Program objectives, concept evaluation, tilt rotor experiments and civil market applications are presented. The XV-15 status and test schedule are also included.

82N23242*# ISSUE 14 PAGE 1903 CATEGORY 5 RPT#: NASA-TM-84180 NAS 1.15:84180 80/00/00 256 PAGES UNCLASSIFIED DOCUMENT
UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshop. Volume 6: Vehicle Configuration Session
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A12/MF A01
Workshop held at Palo Alto, Calif., 2-5 Dec. 1980
MAJS: /*AIRCRAFT CONFIGURATIONS/*AIRCRAFT SAFETY/*HELICOPTER DESIGN/*HIGH SPEED/*ROTARY WING AIRCRAFT/*ROTARY WINGS
MINS: / AERODYNAMIC CONFIGURATIONS/ AIRCRAFT NOISE/ AIRCRAFT RELIABILITY/ DRAG/ FUEL CONSUMPTION/ HELICOPTER CONTROL
ABA: S.L.
ABS: Five high speed rotorcraft configurations are considered: the high speed helicopter, compound helicopter, ABC, tilt rotor and the X wing. The technology requirements and the recommended actions are discussed.

80N10516*# ISSUE 1 PAGE 73 CATEGORY 39 RPT#: NASA-TM-81153 79/10/00 82 PAGES UNCLASSIFIED DOCUMENT
UTTL: Coupled rotor and fuselage equations of motion
AUTH: A/WARMBRODT, W.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A05/MF A01
MAJS: /*EQUATIONS OF MOTION/*FUSELAGES/*HELICOPTER DESIGN/*

MATHEMATICAL MODELS/*ROTARY WINGS
MINS: / AERODYNAMIC CONFIGURATIONS/ AERODYNAMIC LOADS/ AEROELASTICITY/ NONLINEAR EQUATIONS/ ROTOR AERODYNAMICS
ABA: A.W.H.
ABS: The governing equations of motion of a helicopter rotor coupled to a rigid body fuselage are derived. A consistent formulation is used to derive nonlinear periodic coefficient equations of motion which are used to study coupled rotor/fuselage dynamics in forward flight. Rotor/fuselage coupling is documented and the importance of an ordering scheme in deriving nonlinear equations of motion is reviewed. The nature of the final equations and the use of multiblade coordinates are discussed.

80N14107* ISSUE 5 PAGE 565 CATEGORY 5 RPT#: NASA-CASE-ARC-11106-1 US-PATENT-4,168,939 US-PATENT-APPL-SN-831633 US-PATENT-CLASS-416-228 US-PATENT-CLASS-416-238 US-PATENT-CLASS-415-199 79/09/25 23 PAGES UNCLASSIFIED DOCUMENT Filed 8 Sep. 1977 Supersedes N77-31130 (15 - 22, p 2893)
UTTL: Acoustically swept rotor --- helicopter noise reduction TLSP: Patent
AUTH: A/SCHMITZ, F. H.; B/BOXWELL, D. A.; C/VAUSE, R. PAT: C/Inventors (to NASA)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. SAP: Avail: US Patent and Trademark Office
MAJS: /*AEROACOUSTICS/*AERODYNAMIC NOISE/*NOISE REDUCTION/*ROTARY WINGS/*ROTOR AERODYNAMICS/*SWEEP EFFECT
MINS: / FAR FIELDS/ FLOW DISTRIBUTION/ HELICOPTERS/ MATHEMATICAL MODELS/ PATENTS/ TAIL ROTORS
ABA: Official Gazette of the U.S. Patent and Trademark Office
ABS: Impulsive noise reduction is provided in a rotor blade by acoustically sweeping the chord line from root to tip so that the acoustic radiation resulting from the summation of potential singularities used to model the flow about the blade tend to cancel for all times at an observation point in the acoustic far field.

79N32205*# ISSUE 23 PAGE 3043 CATEGORY 6 RPT#: NASA-TM-78611 A-7920 79/09/00 61 PAGES UNCLASSIFIED DOCUMENT
UTTL: Low-cost inertial navigation for moderate-g missions
AUTH: A/MERHAV, S.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*AIR NAVIGATION/*ATTITUDE GYROS/*GIMBALS/*GYROCOMPASSES/*HYBRID NAVIGATION SYSTEMS/*INERTIAL NAVIGATION/*LOW COST
MINS: / ACCELEROMETERS/ GENERAL AVIATION AIRCRAFT/ GYROSCOPIC PENDULUMS/ MATHEMATICAL MODELS/ MICROCOMPUTERS/ POSITION ERRORS/ STRAPDOWN INERTIAL GUIDANCE/ TORQUERS
ABA: A.W.H.
ABS: A low cost inertial navigation system (INS) concept is described for flight missions characterized by moderate accelerations and limited attitude variations. These missions involve general aviation aircraft, helicopters, or remotely piloted vehicles. The significance of the moderate acceleration and limited attitude is reviewed with respect to platform mechanization and instrumentation. A hybrid mechanization, partially gimballed and partially strapdown, is presented. The INS is implemented by an unbalanced two axis gimbal system and controlled by a two degree of freedom gyro. The INS provides locally level two axis acceleration information along with pitch and roll measurements. Heading information is provided by a second gyro mounted in the inner gimbal. The system error model is equivalent to that of a conventional platform with a tilt error determined by the integral of the gyro drift rate and an equivalent accelerometer type errors are also cancelled. Rapid gyro-compassing, implemented with opened gimbal control loops, and a strapdown procedure provides calibration of gyro drift rate biases.

79A49336*# ISSUE 22 PAGE 4097 CATEGORY 5 RPT#: AIAA PAPER 79-1839 79/08/00 11 PAGES UNCLASSIFIED DOCUMENT
UTTL: XV-15 flight test results compared with design goals
AUTH: A/WERNICKE, K. G.; B/MAGEE, J. P. PAA: A/(Bell Helicopter Textron, Fort Worth, Tex.); B/(NASA, Ames Research Center; U.S. Army, Aeromechanics Laboratory, Moffett Field, Calif.)
CORP: Textron Bell Helicopter, Fort Worth, Tex.; National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Research and Technology Labs., Moffett Field, Calif.
American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, New York, N.Y., Aug. 20-22, 1979, 11 p.
MAJS: /*FLIGHT TESTS/*HOVERING STABILITY/*ROTOR AERODYNAMICS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS/*XV-15 AIRCRAFT
MINS: / AEROELASTICITY/ GRAPHS (CHARTS)/ MECHANICAL DRIVES/ NASA PROGRAMS/ ROTARY WINGS/ TABLES (DATA)
ABA: (Author)
ABS: Aircraft No. 2 is presently in the midst of flight envelope expansion. Noise and safety design goals have

been demonstrated; preliminary results indicate that performance and component life goals may also be met. Hovering power indicates a standard hover ceiling of 7,000 feet. After 18.0 hours of flight, a true airspeed of 207 knots has been reached. The goal is a 300-knot cruise speed. So far, XV-15 flight tests indicate no reason why the tilt rotor concept should not fulfill its promise to provide a major step forward in air vehicle flexibility and in rotary wing performance.

79N31137*# ISSUE 22 PAGE 2895 CATEGORY 1 RPT#: NASA-TM-78621 A-7955 79/08/00 36 PAGES UNCLASSIFIED DOCUMENT

UTTL: The promise of multicyclic control --- to control fatiguing blade loads and rotor vibration
AUTH: A/MCCLOUD, J. L., III
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01
MAJS: /*BLADE TIPS/*FLIGHT CONTROL/*HELICOPTER CONTROL/*HELICOPTERS/*LIFTING ROTORS/*ROTOR AERODYNAMICS/*VIBRATION/*VIBRATION DAMPING
MINS: / BENDING MOMENTS/ FEEDBACK CONTROL/ FLIGHT CHARACTERISTICS/ FLIGHT SAFETY/ FLOW DISTRIBUTION/ HELICOPTER PERFORMANCE/ INPUT/OUTPUT ROUTINES/ JET FLAPS
ABA: A.W.H.
ABS: Several types of rotors which employ multicyclic control are reviewed and compared. Their differences are high-lighted and their potential advantages and disadvantages are discussed. The flow field these rotors must operate in is discussed, and it is shown that simultaneous elimination of vibration and oscillatory blade loads is not an inherent solution to the roughness problem. The use of rotor blades as energy absorbers is proposed. Input-output relations are considered and a gain control for ROMULAN, a multicyclic controlling computer program, is introduced. Implications of the introduction of multicyclic systems into helicopters are discussed.

79A47608* ISSUE 21 PAGE 3881 CATEGORY 5 79/06/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Recent V/STOL aircraft designs
AUTH: A/DECKERT, W. H. PAA: A/(NASA, Ames Research Center, V/STOL Aircraft Technology Div., Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
American Helicopter Society, Journal, vol. 24, June 1979, p. 30-37.

MAJS: /*AIRCRAFT CONFIGURATIONS/*TECHNOLOGY ASSESSMENT/*V/STOL AIRCRAFT
MINS: / AIRCRAFT CARRIERS/ DUCTED FANS/ LIFT FANS/ ROTARY WING AIRCRAFT/ THRUST VECTOR CONTROL/ TURBOFAN ENGINES / TURBOJET ENGINES
ABA: B.J.
ABS: The paper reviews the V/STOL aircraft designs pursued by industry from 1971 to 1978, with emphasis on the 1975-1978 period. Consideration is given to those designs pertaining to vertical-attitude and horizontal-attitude V/STOL types. These are divided into such concepts as tilting jet engine, lift/cruise engine, lift engine, lift/cruise fan, ejector augmentor, tilt rotor, stowed rotor, and rotor wing.

79N23977*# ISSUE 15 PAGE 1935 CATEGORY 8 RPT#: NASA-TM-78575 A-7538 79/05/00 28 PAGES UNCLASSIFIED DOCUMENT

UTTL: A simplified rotor system mathematical model for piloted flight dynamics simulation
AUTH: A/CHEN, R. T. N.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01
MAJS: /*FLIGHT SIMULATION/*MATHEMATICAL MODELS/*ROTARY WINGS
MINS: / AERODYNAMIC FORCES/ DYNAMIC CONTROL/ DYNAMIC STABILITY/ EQUATIONS OF MOTION/ FLAPPING HINGES/ MOMENTS/ PITCH (INCLINATION)/ REAL TIME OPERATION/ ROLL
ABA: S.E.S.
ABS: The model was developed for real-time pilot-in-the-loop investigation of helicopter flying qualities. The mathematical model included the tip-path plane dynamics and several primary rotor design parameters, such as flapping hinge restraint, flapping hinge offset, blade lock number, and pitch-flap coupling. The model was used in several exploratory studies of the flying qualities of helicopters with a variety of rotor systems. The basic assumptions used and the major steps involved in the development of the set of equations listed are described. The equations consisted of the tip-path plane dynamic equation, the equations for the main rotor forces and moments, and the equation for control phasing required to achieve decoupling in pitch and roll due to cyclic inputs.

80N15067*# ISSUE 6 PAGE 694 CATEGORY 5 RPT#: NASA-TM-78562 A-7740 AVRADCOM-TR-79-7-AM 79/03/00 73 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/Army XV-15 tilt rotor research aircraft wind-tunnel test program plan --- Ames 40-ft by 80-ft wind tunnel tests

AUTH: A/WEIBERG, J. A.; B/MAISEL, M. D. PAA: B/(AVRADCOM Res. and Technol. Labs.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. SAP: Avail: NASA. Ames Research Center, Moffett Field, Calif. 94035

MAJS: /*PROJECT PLANNING/*RESEARCH AIRCRAFT/*TILT ROTOR AIRCRAFT/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC CHARACTERISTICS/ AEROELASTICITY/ CHECKOUT/ DATA ACQUISITION/ DYNAMIC STABILITY/ LOADS (FORCES)

ABA: A.R.H.

ABS: To ensure that the XV-15 tilt rotor research aircraft will meet the requirements of the program plan and the contract model specification and statement of work, one of the two aircraft will be tested in the Ames 40 x 80 foot wind tunnel to provide an initial assessment of the aerodynamic characteristics, structural loads, and rotor/pylon/wing dynamics in a simulated flight environment for correlation with estimated values. The tests will also serve to verify the functional operation of the aircraft systems and on-board instrumentation in a flight environment. The management structure, operational plan, support requirements and responsibilities, safety provisions and reporting requirements for conduct of the wind tunnel tests are defined and related to other phases of the program.

79N23098*# ISSUE 14 PAGE 1808 CATEGORY 8 RPT#: NASA-TM-78571 A-7769 79/03/00 57 PAGES UNCLASSIFIED DOCUMENT

UTTL: A piloted simulator study on augmentation systems to improve helicopter flying qualities in terrain flight

AUTH: A/CHEN, R. T. N.; B/TALBOT, P. D.; C/GERDES, R. M.; D/DUGAN, D. C.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*AUGMENTATION/*CONTROLLABILITY/*FLIGHT CHARACTERISTICS/*FLIGHT SIMULATION/*HELICOPTER CONTROL

MINS: / DAMPING/ EVALUATION/ PERFORMANCE/ PITCH/ YAW

ABA: L.S.

ABS: Four basic single-rotor helicopters, one teetering, on articulated, and two hingeless, which were found to have a variety of major deficiencies in a previous fixed-based simulator study, were selected as baseline configurations. The stability and control augmentation systems (SCAS) include simple control augmentation systems to decouple pitch and yaw responses due to collective input and to quicken the pitch and roll control responses; SCAS of rate-command type designed to optimize the sensitivity and damping and to decouple the pitch-roll due to aircraft angular rate; and attitude-command type SCAS. Pilot ratings and commentary are presented as well as performance data related to the task. SCAS control usages and their gain levels associated with specific rotor types are also discussed.

79N20111*# ISSUE 11 PAGE 1391 CATEGORY 6 RPT#: NASA-TM-78565 A-7751 79/03/00 133 PAGES UNCLASSIFIED DOCUMENT

UTTL: Survey of helicopter control/display investigations for instrument decelerating approach

AUTH: A/LEBACQZ, J. V.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /*DISPLAY DEVICES/*HELICOPTER CONTROL/*INSTRUMENT APPROACH

MINS: / FLIGHT CONTROL/ FLIGHT TESTS/ GROUND TESTS/ IN-FLIGHT MONITORING/ INSTRUMENT LANDING SYSTEMS/ LANDING AIDS/ PROJECT PLANNING/ WEATHER

ABA: S.E.S.

ABS: Control-display requirements for helicopters conducting decelerating approaches in the terminal area under instrument meteorological conditions were surveyed. The programs are organized on the basis of the control augmentation concepts that were considered, and the results are summarized and compared. Nine control-display combinations are hypothesized as possible candidates for future ground and in-flight investigation. Specific guidelines for the guidance relationship, control characteristics, and display presentation concepts are given.

79N18916*# ISSUE 10 PAGE 1222 CATEGORY 2 RPT#: NASA-TM-78557 A-7731 79/03/00 34 PAGES UNCLASSIFIED DOCUMENT

UTTL: Inertial dyramics of a general purpose rotor

AUTH: A/DUVAL, R. W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*EQUATIONS OF MOTION/*ROTARY WINGS/*ROTOR SYSTEMS RESEARCH AIRCRAFT

MINS: / DATA PROCESSING/ FLAPPING/ MATHEMATICAL MODELS/ ROTARY STABILITY

ABA: Author
ABS: The inertial dynamics of a fully articulated stiff rotor blade are derived with emphasis on equations that facilitate an organized programming approach for simulation applications. The model for the derivation includes hinge offset and six degrees of freedom for the rotor shaft. Results are compared with the flapping and lead-lag equations currently used in the Rotor Systems Research Aircraft simulation model and differences are analyzed.

79A24179*# ISSUE 8 PAGE 1343 CATEGORY 8 RPT#: AD-A072915 79/02/00 5 PAGES UNCLASSIFIED DOCUMENT
UTTL: Calculated hovering helicopter flight dynamics with a circulation-controlled rotor
AUTH: A/JOHNSON, W.; B/CHOPRA, I. PAA: A/(NASA, Ames Research Center; U.S. Army, Aeromechanics Laboratory, Moffett Field, Calif.); B/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif.
Journal of Aircraft, vol. 16, Feb. 1979, p. 124-128.
MAJS: /*AERODYNAMIC CHARACTERISTICS/*HELICOPTER PERFORMANCE /*HOVERING STABILITY/*LIFTING ROTORS/*ROTOR AERODYNAMICS
MINS: / AIRSPEED/ BLOWING/ BOUNDARY LAYER CONTROL/ EIGENVALUES/ HELICOPTER CONTROL/ STABILITY DERIVATIVES
ABA: (Author)
ABS: The flight dynamics of a hovering helicopter with a circulation-controlled rotor are analyzed. The influence of the rotor blowing coefficient on the calculated eigenvalues of the helicopter motion is examined for a range of values of the rotor lift and the blade flap frequency. The control characteristics of a helicopter with a circulation-controlled rotor are discussed. The principal effect of the blowing is a reduction in the rotor speed stability derivative. Above a critical level of blowing coefficient, which depends on the flap frequency and rotor lift, negative speed stability is produced and the dynamic characteristics of the helicopter are radically altered. The handling qualities of a helicopter with negative speed stability are probably unacceptable without a stability augmentation system.

79N17847* ISSUE 9 PAGE 1076 CATEGORY 5 RPT#: NASA-CASE-ARC-11045-1 US-PATENT-4,137,010 US-PATENT-APPL-SN-818916 US-PATENT-CLASS-416-51 US-PATENT-CLASS-416-88 US-PATENT-CLASS-416-89 US-PATENT-CLASS-416-132R US-PATENT-CLASS-416-138 79/01/30 8 PAGES UNCLASSIFIED DOCUMENT Filed 25 Jul. 1977 Supersedes N77-2811 (15 - 19, p 2486)
UTTL: Constant lift rotor for a heavier than air craft
TLSP: Patent
AUTH: A/STROUB, R. H. PAT: A/Inventor (to NASA)
CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif. SAP: Avail: US Patent and Trademark Office.
MAJS: /*HELICOPTERS/*ROTOR LIFT/*ROTORCRAFT AIRCRAFT
MINS: / PATENTS/ PITCH (INCLINATION)/ ROTOR AERODYNAMICS/ ROTOR BLADES/ TRAILING EDGES
ABA: Official Gazette of the U.S. Patent and Trademark Office
ABS: A rotor blade extended radially from a hub, characterized by an elongated spar and a plurality of axially aligned shells pivotally mounted on the spar is presented. Each has an aerodynamic center located in trailing relation with the spar and supported thereby for simultaneous axial and angular displacement as centrifugal forces are applied, a pitch controller plus a plurality of pivotal pitch limiting arms transversely related to the spar. A push-pull link interconnecting the arms is used for imparting simultaneous pivotal motion, whereby the angular relationship of the arms to the spar is varied for varying the motion of the trucks along the arms for thus limiting the pitch of the segments about the spar.

80A17717* ISSUE 5 PAGE 748 CATEGORY 5 CNT#: NSG-1578 79/00/00 27 PAGES UNCLASSIFIED DOCUMENT
UTTL: Formulation of coupled rotor/fuselage equations of motion
AUTH: A/WARMBROD, W.; B/RIEDMANN, P. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.); B/(California, University, Los Angeles, Calif.)
CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; California Univ., Los Angeles.
Vertica, vol. 3, no. 3-4, 1979, p. 245-271.
MAJS: /*AERODYNAMIC STABILITY/*AEROELASTICITY/*EQUATIONS OF MOTION/*FUSELAGES/*HELICOPTER TAIL ROTORS
MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC FORCES/ MATHEMATICAL MODELS/ PARTIAL DIFFERENTIAL EQUATIONS/ RIGID STRUCTURES
ABA: (Author)
ABS: The governing equations of motion of a helicopter

rotor coupled to a rigid body fuselage are derived. A consistent formulation is used to derive nonlinear periodic coefficient equations of motion which can be used to study coupled rotor/fuselage dynamics in forward flight. The methodology of rotor/fuselage coupling is clearly described and the importance of an ordering scheme in deriving consistent nonlinear equations of motion is reviewed. The final equations which are presented in partial differential form can be used to model coupled rotor/fuselage aeroelastic response or stability problems.

79A53627*# ISSUE 24 PAGE 4467 CATEGORY 3
79/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flight controls/avionics research - Impact on future civil helicopter operating efficiency and mission reliability

AUTH: A/SNYDER, W. J.; B/CHRISTENSEN, J. V. PAA: B/(NASA, Ames Research Center, Helicopter Systems Office, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

In: Specialists Meeting on Helicopter Flight Controls, Arlington, Tex., October 11-13, 1978. Technical Papers. (A79-53626 24-08) Washington, D.C., American Helicopter Society, 1979. 12 p.

MAJS: /*AIRCRAFT RELIABILITY/*AVIONICS/*CIVIL AVIATION/*HELICOPTER CONTROL/*HELICOPTER PERFORMANCE/*TECHNOLOGY ASSESSMENT

MINS: / AIR NAVIGATION/ AIR TRANSPORTATION/ FLIGHT CONTROL/ FUEL CONSUMPTION/ RESEARCH AND DEVELOPMENT/ TECHNOLOGICAL FORECASTING/ TECHNOLOGY UTILIZATION

ABA: B.J.

ABS: Operational efficiency and mission reliability are key capabilities which will impact the future use of helicopters in the civil segment and areas where flight control/avionics research can play a major role. The present paper reviews flight control/avionics system needs for each major area of civil helicopter use. Technology requirements to meet civil needs are discussed. The review points up the need for the development of all-weather flight control concepts and the validation of cost effective active control/fly-by-wire/fly-by-light system concepts with modular architecture which can be tailored to specific mission requirements.

79A49105* ISSUE 21 PAGE 3885 CATEGORY 5 RPT#: AHS 79-54 79/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind tunnel and flight test of the XV-15 Tilt Rotor Research Aircraft

AUTH: A/MARR, R. L.; B/BLACKMAN, S.; C/WEIBERG, J. A.; D/SCHROERS, L. G. PAA: B/(Bell Helicopter Textron, Fort Worth, Tex.); C/(NASA, Ames Research Center, Moffett Field, Calif.); D/(U.S. Army, Aeromechanics Laboratory, Moffett Field, Calif.)

CORP: Textron Bell Helicopter, Fort Worth, Tex.; National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; Army Research and Technology Labs., Moffett Field, Calif.

In: American Helicopter Society, Annual National Forum, 35th, Washington, D.C., May 21-23, 1979, Proceedings. (A79-49053 21-01) Washington, D.C., American Helicopter Society, 1979. 12 p.

MAJS: /*FLIGHT TESTS/*HOVERING STABILITY/*WIND TUNNEL TESTS/*XV-15 AIRCRAFT

MINS: / AIRCRAFT DESIGN/ FLIGHT CHARACTERISTICS/ GRAPHS (CHARTS)/ GROUND TESTS/ ROTOR AERODYNAMICS/ STRUCTURAL DESIGN CRITERIA/ TECHNOLOGY ASSESSMENT/ TILT ROTOR RESEARCH AIRCRAFT PROGRAM

ABA: (Author)

ABS: The XV-15 Tilt Rotor Research Aircraft Project involves design, fabrication, and flight testing of two aircraft. This program is currently in the test phase for concept evaluation and substantiation of design. As part of this evaluation, one of the aircraft was tested in the NASA-Ames 40- by 80-foot wind tunnel. The status of testing to date and some of the results of the wind tunnel and flight tests are presented.

79A49104*# ISSUE 21 PAGE 3880 CATEGORY 4 RPT#: AHS 79-52 79/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flight investigation of helicopter IFR approaches to oil rigs using airborne weather and mapping radar

AUTH: A/BULL, J. S.; B/HEGARTY, D. M.; C/PHILLIPS, J. D.; D/STURGEON, W. R.; E/HUNTING, A. W.; F/PATE, D. P. PAA: D/(NASA, Ames Research Center, Moffett Field, Calif.); F/(FAA, Flight Standards National Field Office, Oklahoma City, Okla.)

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; Federal Aviation Administration, Oklahoma City, Okla.

In: American Helicopter Society, Annual National Forum, 35th, Washington, D.C., May 21-23, 1979, Proceedings. (A79-49053 21-01) Washington, D.C., American Helicopter Society, 1979. 10 p.

MAJS: /*FLIGHT TESTS/*HELICOPTER CONTROL/*INSTRUMENT FLIGHT RULES/*LANDING RADAR/*OFFSHORE PLATFORMS/*RADAR APPROACH CONTROL/*RADAR NAVIGATION

MINS: / FLIGHT CONDITIONS/ INSTRUMENT LANDING SYSTEMS/ LANDING AIDS/ METEOROLOGICAL RADAR/ PRODUCT DEVELOPMENT/ RADAR MAPS/ TABLES (DATA)
ABA: (Author)
ABS: Airborne weather and mapping radar is a near-term, economical method of providing 'self-contained' navigation information for approaches to offshore oil rigs and its use has been rapidly expanding in recent years. A joint NASA/FAA flight test investigation of helicopter IFR approaches to offshore oil rigs in the Gulf of Mexico was initiated in June 1976 and conducted under contract to Air Logistics. Approximately 120 approaches were flown in a Bell 212 helicopter by 15 operational pilots during the months of August and September 1978. The purpose of the tests was to collect data to (1) support development of advanced radar flight director concepts by NASA and (2) aid the establishment of Terminal Instrument Procedures (TERPS) criteria by the FAA. The flight test objectives were to develop airborne radar approach procedures, measure tracking errors, determine accpetable weather minimums, and determine pilot acceptability. Data obtained will contribute significantly to improved helicopter airborne radar approach capability and to the support of exploration, development, and utilization of the Nation's offshore oil supplies.

79A49078*# ISSUE 21 PAGE 3892 CATEGORY 8 RPT#: AHS 79-26 79/00/00 27 PAGES UNCLASSIFIED DOCUMENT
UTTL: Piloted simulator investigation of helicopter control systems effects on handling qualities during instrument flight
AUTH: A/FORREST, R. D.; B/CHEN, R. T. N.; C/GERDES, R. M.; D/ALDERETE, T. S.; E/GEE, D. R. PAA: A/(FAA, Washington, D.C.); E/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: Federal Aviation Administration, Washington, D.C.; National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
In: American Helicopter Society, Annual National Forum, 35th, Washington, D.C., May 21-23, 1979, Proceedings. (A79-49053 21-01) Washington, D.C., American Helicopter Society, 1979. 27 p.
MAJS: /*AUTOMATIC FLIGHT CONTROL/*CONTROL STABILITY/*FLIGHT SIMULATORS/*HELICOPTER CONTROL/*HELICOPTER PERFORMANCE/*INSTRUMENT FLIGHT RULES/*MAN MACHINE SYSTEMS
MINS: / AIRCRAFT CONFIGURATIONS/ AIRCRAFT RELIABILITY/ FLIGHT CONDITIONS/ GRAPHS (CHARTS)/ SYSTEMS ENGINEERING/ TABLES (DATA)
ABS: An exploratory piloted simulation was conducted to investigate the effects of the characteristics of helicopter flight control systems on instrument flight handling qualities. This joint FAA/NASA study was motivated by the need to improve instrument flight capability. A near-term objective is to assist in updating the airworthiness criteria for helicopter instrument flight. The experiment consisted of variations of single-rotor helicopter types and levels of stability and control augmentation systems (SCAS). These configurations were evaluated during an omnirange approach task under visual and instrument flight conditions. The levels of SCAS design included a simple rate damping system, collective decoupling plus rate damping, and an attitude command system with collective decoupling. A limited evaluation of stick force versus airspeed stability was accomplished. Some problems were experienced with control system mechanization which had a detrimental effect on longitudinal stability. Pilot ratings, pilot commentary, and performance data related to the task are presented.

79A45413*# ISSUE 19 PAGE 3557 CATEGORY 8 RPT#: AIAA 79-1886 79/00/00 15 PAGES UNCLASSIFIED DOCUMENT
UTTL: A piloted simulator investigation of helicopter precision decelerating approaches to hover to determine single-pilot IFR /SPIFR/ requirements
AUTH: A/PHATAK, A. V.; B/PEACH, L. L., JR.; C/HESS, R. A.; D/ROSS, V. L.; E/HALL, G. W.; F/GERDES, R. M. PAA: A/(Analytical Mechanics Associates, Inc., Mountain View, Calif.); F/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: Analytical Mechanics Associates, Inc., Mountain View, Calif.; National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
In: Guidance and Control Conference, Boulder, Colo., August 6-8, 1979, Collection of Technical Papers. (A79-45351 19-12) New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 594-608.
MAJS: /*CONTROL STABILITY/*DECELERATION/*FLIGHT SIMULATION/*HELICOPTER CONTROL/*HOVERING STABILITY/*INSTRUMENT FLIGHT RULES
MINS: / AIRCRAFT GUIDANCE/ BLOCK DIAGRAMS/ GRAPHS (CHARTS)/ HOVERING/ SYSTEMS ANALYSIS/ SYSTEMS ENGINEERING/ TABLES (DATA)
ABA: V.T.
ABS: The results of single-pilot instrument flight rules (SPIFR) experiments conducted on the NASA-Ames V/STOLAND simulator are presented. Several factors having a significant impact on requirements for helicopter SPIFR decelerating, steep approaches to landing are considered: (1) approach weather conditions, (2) flight path geometry, (3) deceleration

guidance law. (4) level of stability and command augmentation. (5) cockpit display sophistication. (6) accuracy of navigation aids. and (7) helipad lighting and visual aids. Particular emphasis is placed on the relative effects of deceleration profile. control augmentation. and flight director parameters on pilot performance. workload. and opinion rating. Problems associated with the development of a pilot acceptance analytical methodology are outlined.

79A45345*# ISSUE 19 PAGE 3555 CATEGORY 8 RPT#: AIAA 79-1683 79/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: A review of helicopter control-display requirements for decelarating instrument approach

AUTH: A/LEBACQZ. J. V. PAA: A/(NASA. Ames Research Center. Moffett Field. Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center. Moffett Field. Calif.

In: Atmospheric Flight Mechanics Conference for Future Space Systems. Boulder. Colo.. August 6-8. 1979. Collection of Technical Papers. (A79-45302 19-01) New York. American Institute of Aeronautics and Astronautics. Inc.. 1979. p. 426-439.

MAJS: /*AIRCRAFT STABILITY/*APPROACH CONTROL/*DISPLAY DEVICES/*FLIGHT CONDITIONS/*HELICOPTER PERFORMANCE/* INSTRUMENT APPROACH

MINS: / AIRCRAFT GUIDANCE/ DIRECTIONAL CONTROL/ FLIGHT CONTROL/ FLIGHT TESTS/ GROUND BASED CONTROL/ LATERAL CONTROL

ABA: (Author)

ABS: This paper reviews research and operational test programs that have dealt with control and display requirements for helicopters performing decelerating approaches in the terminal area under instrument flight conditions. A survey of literature concentrating on flight programs resulted in approximately 50 applicable references which were summarized and classified according to the type of stability/control augmentation that was emphasized. On this basis. display information requirements for each control system type were hypothesized consistent with documented results of these programs. Nine control-display combinations that appear to warrant further ground simulation and flight testing are defined and discussed.

79A29006*# ISSUE 11 PAGE 2046 CATEGORY 39 RPT#: AIAA 79-0732 CNT#: NSG-3082 NGR-05-007-414 79/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Formulation of the aeroelastic stability and response problem of coupled rotor/support systems

AUTH: A/WARMBRODT. W.; B/FRIEDMANN. P. PAA: A/(NASA. Ames Research Center. Moffett Field. Calif.); B/(California. University. Los Angeles. Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center. Moffett Field. Calif.; California Univ.. Los Angeles.

In: Structures. Structural Dynamics. and Materials Conference. 20th. St. Louis. Mo.. April 4-6. 1979. Technical Papers on Structures and Materials. (A79-29002 11-39) New York. American Institute of Aeronautics and Astronautics. Inc.. 1979. p. 39-52. Army-supported research:

MAJS: /*AEROELASTICITY/*DYNAMIC STABILITY/*ROTORS/* STRUCTURAL STABILITY/*SYSTEMS STABILITY

MINS: / EQUATIONS OF MOTION/ NONLINEAR EQUATIONS/ PYLONS/ ROTARY WINGS/ SUPPORTS/ WINDMILLS (WINDPOWERED MACHINES)

ABA: (Author)

ABS: The consistent formulation of the governing nonlinear equations of motion for a coupled rotor/support system is presented. Rotor/support coupling is clearly documented by enforcing dynamic equilibrium between the rotor and the moving flexible support. The nonlinear periodic coefficient equations of motion are applicable to both coupled rotor/fuselage aeroelastic problems of helicopters in hover or forward flight and coupled rotor/tower dynamics of a large horizontal axis wind turbine (HAWT). Finally. the equations of motion are used to study the influence of flexible supports and nonlinear terms on rotor aeroelastic stability and response of a large two-bladed HAWT.

79A27371*# ISSUE 10 PAGE 1546 CATEGORY 5 RPT#: AIAA 79-0704 79/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: XV-15 Tilt Rotor Research Aircraft - Program report

AUTH: A/MAGEE. J. P.; B/WERNICKE. K. G. PAA: A/(NASA. Ames Research Center; U.S. Army. Aeromechanics Laboratory. Moffett Field. Calif.); B/(Bell Helicopter Textron. Fort Worth. Tex.)

CORP: National Aeronautics and Space Administration. Ames Research Center. Moffett Field. Calif.; Army Research and Technology Labs.. Moffett Field. Calif.; Textron Bell Helicopter. Fort Worth. Tex.

In: Atlantic Aeronautical Conference. Williamsburg. Va.. March 26-28. 1979. Technical Papers. (A79-27351 10-05) New York. American Institute of Aeronautics and Astronautics. Inc.. 1979. p. 201-210.

MAJS: /*AIRCRAFT PERFORMANCE/*FLIGHT TESTS/*FULL SCALE TESTS /*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS/*XV-15 AIRCRAFT
MINS: / AIRCRAFT DESIGN/ AIRCRAFT NOISE/ PERFORMANCE TESTS/ RESEARCH AIRCRAFT/ STRUCTURAL VIBRATION/ TILT ROTOR AIRCRAFT
ABA: (Author)
ABS: This paper is a status report of the NASA/Army XV-15 Project. The basic tilt-rotor concept and the XV-15 Tilt-Rotor Research Aircraft are discussed and some results of full-scale wind-tunnel tests in the Ames 40- by 80-Foot Wind Tunnel are presented. Flight-test data are included to give preliminary performance, noise, and vibration data in hover and as far into transition flight as are available at the time of presentation. Information concerning vehicle aerodynamics and airloads obtained as a result of both wind-tunnel and flight tests are provided with some conclusions as to the ramifications of the data in terms of design criteria and configuration layout.

79A18574* ISSUE 5 PAGE 746 CATEGORY 3 CNT#: NSG-1121 78/11/00 17 PAGES UNCLASSIFIED DOCUMENT
UTTL: Role of helicopters in airport access
AUTH: A/DAJANI, J. S.; B/SNYDER, W. J. PAA: A/(Stanford University, Stanford, Calif.); B/(NASA, Ames Research Center, Helicopter Systems Office, Moffett Field, Calif.)
CORP: Stanford Univ., Calif.; National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ASCE, Transportation Engineering Journal, vol. 104, Nov. 1978, p. 799-815.
MAJS: /*AIR TRANSPORTATION/*AIRPORTS/*HELICOPTERS/*RAPID TRANSIT SYSTEMS/*URBAN TRANSPORTATION
MINS: / COMPUTERIZED SIMULATION/ COSTS/ ECONOMIC ANALYSIS/ FEASIBILITY ANALYSIS/ PASSENGERS/ SYSTEMS ANALYSIS/ TECHNOLOGICAL FORECASTING
ABA: S.D.
ABS: The paper briefly reviews the role of helicopter systems in the provision of airport access services and evaluates the potential for the future development of such services in major metropolitan areas in the United States. The evaluation is based on a computer simulation of potential helicopter system proposed for 20 metropolitan areas. The simulation provides two indicators that are used to gage the extent of the feasibility of developing successful systems in these areas: (1) the cost per seat mile, and (2) the break-even number of passengers, expressed as a percentage of total air travelers. It is found that a few metropolitan areas presently have the potential of marginally supporting intra-urban helicopter airport access service. The access systems offer a viable alternative for air passengers placing a high value on their time, and provides the opportunity for better integrating the air transportation service of multiple airports in a given urban region.

79N12019*# ISSUE 3 PAGE 274 CATEGORY 2 RPT#: NASA-TM-78539 AVRADCOM-TR-78-56(AM) A-7661 78/11/00 18 PAGES UNCLASSIFIED DOCUMENT
UTTL: Comprehensive helicopter analysis: A state of the art review
AUTH: A/JOHNSON, W.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.
MAJS: /*AERODYNAMIC CHARACTERISTICS/*COMPUTERIZED DESIGN/*HELICOPTERS/*TECHNOLOGY ASSESSMENT
MINS: / AERODYNAMIC LOADS/ AEROELASTICITY/ CONTROLLABILITY/ DYNAMIC STRUCTURAL ANALYSIS/ STRUCTURAL VIBRATION
ABA: Author
ABS: An assessment of the status of helicopter theory and analysis is presented. The technology level embodied in available design tools (computer programs) is examined, considering the problem areas of performance, loads and vibration, handling qualities and simulation, and aeroelastic stability. The effectiveness of the present analyses is discussed. The characteristics of the technology in the analyses are reviewed, including the aerodynamics technology, induced velocity and wake geometry, dynamics technology, and machine limitations.

79N15977*# ISSUE 7 PAGE 821 CATEGORY 9 78/10/00 17 PAGES UNCLASSIFIED DOCUMENT
UTTL: Mission environment simulation for Army rotorcraft development: Requirements and capabilities
AUTH: A/KEY, D. L.; B/ODNEAL, B. L.; C/SINACORI, J. B.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A14/MF A01
In AGARD Piloted Aircraft Environ. Simulation Tech. 17 p (SEE N79-15973 07-09) Prepared in cooperation with Army Aviation Res. and Develop. Command, Moffett Field, Calif.
MAJS: /*DISPLAY DEVICES/*ENVIRONMENT SIMULATION/*FLIGHT SIMULATION/*ROTORCRAFT AIRCRAFT
MINS: / COMPUTERIZED SIMULATION/ HELICOPTERS/ IMAGERY/ SYSTEMS ENGINEERING/ TELEVISION CAMERAS/ TRAINING

DEVICES/ VISIBILITY.

ABA: G.Y.

ABS: The rich and varied detail visible in terrain flight must be presented by a wide field-of-view system with much detail and high resolution. The rotary-wing R&D simulator must have great versatility for easy change of cab configurations and the capability to accommodate a two or three man crew. Basic specifications for an adequate visual display were developed and are compared with current and forecasted techniques for image generation and presentation. Results of a study performed to determine the feasibility of meeting these requirements using the current technology of TV camera-model image generation and projected display are discussed and an assessment of the possibility that computer generated imagery can achieve the desired level of detail is presented.

79N10046*# ISSUE 1 PAGE 7 CATEGORY 5 RPT#: NASA-TM-78522 A-7602 78/09/00 30 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flight research capabilities of the NASA/Army rotor systems research aircraft

AUTH: A/WHITE, S., JR.; B/CONDON, G. W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*ROTOR SYSTEMS RESEARCH AIRCRAFT

MINS: / EFFICIENCY/ EVALUATION/ RESEARCH

ABA: L.S.

ABS: A description is given of the capabilities and limitations of the Rotor Systems Research Aircraft (RSRA) that was demonstrated during the development contract, and assesses the expected research capabilities of the RSRA on delivery to the government.

78A49790*# ISSUE 22 PAGE 3969 CATEGORY 9 RPT#: AIAA PAPER 78-1515 78/08/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: V/STOL aircraft simulation - Requirements and capabilities at Ames Research Center

AUTH: A/WILCOX, D. E.; B/QUIGLEY, H. C. PAA: B/(NASA, Ames Research Center, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Conference, Los Angeles, Calif., Aug. 21-23, 1978, 12 p.

MAJS: /*COMPUTERIZED SIMULATION/*FLIGHT CONTROL/*FLIGHT SIMULATION/*FLIGHT SIMULATORS/*V/STOL AIRCRAFT

MINS: / AIRCRAFT DESIGN/ AIRCRAFT PERFORMANCE/ DIAGRAMS/ EQUATIONS OF MOTION/ GROUND TESTS/ SYSTEMS ANALYSIS/ TECHNOLOGY ASSESSMENT/ TERRAIN ANALYSIS

ABA: (Author)

ABS: Ground-based flight simulation contributes greatly to the development of new aircraft and flight management systems and will be especially important in improving the performance, safety, and environmental characteristics of future civil and military V/STOL aircraft. This paper describes existing simulation facilities at Ames Research Center and discusses their capabilities and limitations for V/STOL aircraft investigations. Simulation requirements for NASA research and support of DOD programs are also discussed, including technology development for advanced rotorcraft and civil and military V/STOL aircraft. Current efforts and future plans are described for the upgrading of Ames simulation facilities to meet those requirements. Recent advances in equipment technology and operational methodology are shown to provide significantly improved simulation fidelity through better motion and visual cues and faster system response to pilot inputs.

79N10864*# ISSUE 1 PAGE 114 CATEGORY 71 78/08/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aeroacoustic research: An Army perspective

AUTH: A/MORSE, H. A.; B/SCHMITZ, F. H.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Research and Technology Labs., Fort Eustis, Va. AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 797-817 (SEE N79-10843 01-71) Prepared in cooperation with Army Res. and Technol. Labs., Fort Eustis, Va.

MAJS: /*AEROACOUSTICS/*AIRCRAFT NOISE/*HELICOPTERS/*RESEARCH MANAGEMENT

MINS: / AERODYNAMIC NOISE/ HELICOPTER PERFORMANCE/ MILITARY TECHNOLOGY/ NASA PROGRAMS/ NOISE REDUCTION/ ROTARY WINGS

ABA: J.M.S.

ABS: A short perspective of the Army aeroacoustic research program is presented that emphasizes rotary wing, aerodynamically generated noise. Exciting breakthroughs in experimental techniques and facilities are reviewed which are helping build a detailed understanding of helicopter external noise. Army and joint Army/NASA supported research programs in acoustics which promise to reduce the noise of future helicopters without severe performance penalties are included.

78N32835*# ISSUE 23 PAGE 3139 CATEGORY 71
78/08/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: A study of the noise radiation from four helicopter rotor blades --- tests in Ames 40 by 20 foot wind tunnel

AUTH: A/LEE, A.; B/MOSHER, M. PAA: A/(Beam Eng., Inc.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 387-402 (SEE N78-32816 23-71)

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE PROPAGATION/* ROTARY WINGS/*WIND TUNNEL TESTS

MINS: / AEROACOUSTICS/ BLADE TIPS/ NOISE POLLUTION/ NOISE REDUCTION/ POLLUTION CONTROL/ ROTOR AERODYNAMICS/ THICKNESS RATIO

ABA: J.M.S.

ABS: Accustic measurements were taken of a modern helicopter rotor with four blade tip shapes in the NASA Ames 40-by-80-Foot Wind Tunnel. The four tip shapes are: rectangular, swept, trapezoidal, and swept tapered in platform. Accustic effects due to tip shape changes were studied based on the dBA level, peak noise pressure, and subjective rating. The swept tapered blade was found to be the quietest above an advancing tip Mach number of about 0.9, and the swept blade was the quietest at low speed. The measured high speed impulsive noise was compared with theoretical predictions based on thickness effects; good agreement was found.

78N32831*# ISSUE 23 PAGE 3138 CATEGORY 71
78/08/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hovering impulsive noise: Some measured and calculated results

AUTH: A/BOXWELL, D. A.; B/YU, Y. H.; C/SCHMITZ, F. H. PAA: A/(AVRADCOM Res. and Technol. Labs.); B/(AVRADCOM Res. and Technol. Labs.); C/(AVRADCOM Res. and Technol. Labs.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 309-322 (SEE N78-32816 23-71)

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*HOVERING/*ROTARY WINGS

MINS: / AEROACOUSTICS/ BLADE TIPS/ NOISE POLLUTION/ POLLUTION CONTROL/ PREDICTION ANALYSIS TECHNIQUES

ABA: J.M.S.

ABS: In-plane impulsive noise radiating from a hovering model rotor was measured in an anechoic environment. The hover acoustic signature was compared with existing theoretical prediction models with previous forward flight experiments using the same model rotor. These hover tests showed good experimental consistency with forward flight measurements, both in pressure level, and waveform character, over the range of Mach numbers tested (0.8 to 1.0). Generally poor correlation, however, was confirmed with current linear theory prediction efforts. Failure to predict both the peak pressure levels and the shape was reported, especially with increasing tip Mach number.

78N27113*# ISSUE 18 PAGE 2352 CATEGORY 5 RPT#: NASA-TP-1267 A-7343 78/07/00 37 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of special-purpose digital computers to rotorcraft real-time simulation

AUTH: A/MACKIE, D. B.; B/MICHELSON, S. PAA: B/(Computer Sci. Corp., Mountain View, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*CASCADE CONTROL/*COMPUTERIZED SIMULATION/*FORTRAN/* ROTORCRAFT AIRCRAFT

MINS: / CENTRAL PROCESSING UNITS/ COMPUTER TECHNIQUES/ FORTRAN/ KINEMATIC EQUATIONS/ REAL TIME OPERATION

ABA: G.G.

ABS: The use of an array processor as a computational element in rotorcraft real-time simulation is studied. A multilooping scheme was considered in which the rotor would loop over its calculations a number of time while the remainder of the model cycled once on a host computer. To prove that such a method would realistically simulate rotorcraft, a FORTRAN program was constructed to emulate a typical host-array processor computing configuration. The multilooping of an expanded rotor model, which included appropriate kinematic equations, resulted in an accurate and stable simulation.

78N29044*# ISSUE 20 PAGE 2617 CATEGORY 1 RPT#: NASA-TM-78489 AVRADCOM-TR-78-17(AM) A-7430 78/06/00 49 PAGES UNCLASSIFIED DOCUMENT

UTTL: An experimental investigation of hingeless helicopter rotor-body stability in hover

AUTH: A/BOUSMAN, W. G.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, St. Louis, Mo. AVAIL.NTIS SAP: HC A03/MF A01
Prepared in cooperation with US Army Aviation Research and Development Command, St. Louis, Mo.

MAJS: /*HELICOPTER PERFORMANCE/*HOVERING STABILITY/*RIGID ROTORS/*ROTARY STABILITY/*ROTARY WINGS/*STABILITY TESTS

MINS: / DAMPING TESTS/ DYNAMIC RESPONSE/ ROTOR SPEED/ SCALE MODELS/ VACUUM TESTS
ABA: Author
ABS: Model tests of a 1.62 m diameter rotor were performed to investigate the aeromechanical stability of coupled rotor-body systems in hover. Experimental measurements were made of modal frequencies and damping over a wide range of rotor speeds. Good data were obtained for the frequencies of the rotor lead-lag regressing mode. The quality of the damping measurements of the body modes was poor due to nonlinear damping in the gimbal ball bearings. Simulated vacuum testing was performed using substitute blades of tantalum that reduced the effective lock number to 0.2% of the model scale value while keeping the blade inertia constant. The experimental data were compared with theoretical predictions, and the correlation was in general very good.

78N27043*# ISSUE 17 PAGE 2341 CATEGORY 99
RPT#: NASA-TM-78498 A-7488 78/06/00 24 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Application of a cost/performance measurement system on a research aircraft project
AUTH: A/DIEHL, J. J.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A02/MF A01
MAJS: /*AIRCRAFT PERFORMANCE/*AIRPLANE PRODUCTION COSTS/* COSTS/*PROCUREMENT MANAGEMENT/*PROJECT MANAGEMENT/* RESEARCH AIRCRAFT/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM
MINS: / CONTRACT NEGOTIATION/ COST ANALYSIS/ GOVERNMENT/INDUSTRY RELATIONS/ PROCUREMENT POLICY
ABA: A.R.H.
ABS: The fundamentals of the cost/performance management system used in the procurement of two tilt rotor aircraft for a joint NASA/Army research project are discussed. The contractor's reporting system and the GPO's analyses are examined. The use of this type of reporting system is assessed. Recommendations concerning the use of like systems on future projects are included.

79N10947*# ISSUE 1 PAGE 126 CATEGORY 85
78/05/00 35 PAGES UNCLASSIFIED DOCUMENT
UTTL: Planning for airport access: An analysis of the San Francisco Bay area. Technological options
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A13/MF A01
In its Planning for Airport Access p 115-188 (SEE N79-10942 01-85)
MAJS: /*AIRPORT PLANNING/*SAN FRANCISCO BAY (CA)/*TECHNOLOGY ASSESSMENT/*URBAN TRANSPORTATION
MINS: / AUTOMATIC CONTROL/ AUTOMOBILES/ COSTS/ HELICOPTERS/ HIGHWAYS/ HULLS (STRUCTURES)/ RAPID TRANSIT SYSTEMS/ VERTICAL TAKEOFF AIRCRAFT/ WATER VEHICLES
ABA: S.E.S.
ABS: Current transportation technology and expected technological trends are reviewed. These technologies are assessed within the framework of the airport access system in the San Francisco Bay area. Four types of technological options are considered: (1) automotive systems, (2) commuter air systems, (3) automated guideways, and (4) water systems.

78N21159*# ISSUE 12 PAGE 1537 CATEGORY 8 RPT#: NASA-TM-78475 A-7367 78/04/00 11 PAGES
UNCLASSIFIED DOCUMENT
UTTL: A note on multicyclic control by swashplate oscillation
AUTH: A/BIGGERS, J. C.; B/MCCLOUD, J. L., III
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A02/MF A01
MAJS: /*HARMONIC OSCILLATION/*ROTOR BLADES (TURBOMACHINERY) /*SPLASHING
MINS: / AZIMUTH/ HELICOPTERS/ PITCHING MOMENTS/ VIBRATION
ABA: Author
ABS: It was shown that for two, three, or four bladed rotors, simple oscillation of the nonrotating swashplate controls can produce prescribed blade pitch schedules of the sort which were suggested for vibration alleviation. Equations were given which relate the swashplate motions to the resulting blade pitch schedules.

78N20917*# ISSUE 11 PAGE 1501 CATEGORY 71
RPT#: NASA-TM-78473 A-7355 CNT#: NAS2-9399
78/03/00 29 PAGES UNCLASSIFIED DOCUMENT
UTTL: Comparison of measured and calculated helicopter rotor impulsive noise --- wind tunnel test data and prediction analysis techniques
AUTH: A/JOHNSON, W.; B/LEE, A. PAA: B/(Beam Eng., Inc.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC A03/MF A01
MAJS: /*AIRCRAFT NOISE/*IMPULSE GENERATORS/*NOISE MEASUREMENT/*PREDICTION ANALYSIS TECHNIQUES/*ROTARY WINGS/*WIND TUNNEL TESTS
MINS: / BLADE TIPS/ HELICOPTER PERFORMANCE/ NOISE REDUCTION/ SOUND PRESSURE
ABA: Author

ABS: The thickness noise theory is discussed. Two full-scale rotors were tested in a wind tunnel with several tips involving changes in chord, thickness, and sweep. Impulsive noise data reduction procedures used are described. The calculated and measured impulsive noise peak pressures as a function of advancing tip Mach number are compared, showing good correlation for all rotors considered.

78N20113*# ISSUE 11 PAGE 1394 CATEGORY 5 RPT#: NASA-TM-78452 A-7134 78/03/00 17 PAGES
UNCLASSIFIED DOCUMENT
UTTL: A simple method for estimating minimum autorotative descent rate of single rotor helicopters
AUTH: A/TALBOT, P. D.; B/SCHROERS, L. G. PAA: B/(Army R & T Labs., Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01
MAJS: /*AUTOROTATION/*DESCENT TRAJECTORIES/*HELICOPTER PERFORMANCE/*ROTARY WINGS
MINS: / ENERGY CONSUMPTION/ ESTIMATES/ FLIGHT TESTS/ FREE FLIGHT/ PERFORMANCE PREDICTION/ PREDICTION ANALYSIS TECHNIQUES
ABA: Author
ABS: Flight test results of minimum autorotative descent rate are compared with calculations based on the minimum power required for steady level flight. Empirical correction factors are derived that account for differences in energy dissipation between these two flight conditions. A method is also presented for estimating the minimum power coefficient for level flight for any helicopter for use in the empirical estimation procedure of autorotative descent rate.

78N22055*# ISSUE 13 PAGE 1658 CATEGORY 2 CNT#: NCA2-OR-745-602 NSG-2253 78/02/00 32 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Dynamic stall of an oscillating airfoil
AUTH: A/MEHTA, U. B. PAA: A/(Stanford Univ., Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A99/MF A01
In AGARD Unsteady Aerodyn. 32 p (SEE N78-22033 13-02) Sponsored in part by ARMDL
MAJS: /*AERODYNAMIC STALLING/*AIRFOILS/*BOUNDARY LAYER SEPARATION/*OSCILLATIONS/*UNSTEADY FLOW
MINS: / HELICOPTERS/ LAMINAR FLOW/ NAVIER-STOKES EQUATION/ SCALE MODELS/ VORTICITY/ WAKES
ABA: Author
ABS: Unsteady separated boundary layers and wakes were studied by investigating flow past an oscillating airfoil which in part models the retreating blade stall on the helicopters. The Navier-Stokes equations in terms of the vorticity and stream function for laminar flow were solved to determine the flow field around a modified NACA 0012 airfoil. After a fully developed flow was determined at zero incidence, the airfoil was oscillated in pitch through an angle of attack range from 0 deg to 20 deg. The computed streamlines during this pitch-up motion are in qualitative agreement with the trajectories of air bubbles observed in water tunnel experiments conducted with a NACA 0012 airfoil under the same conditions. During the pitch-down motion of the airfoil, the computed flow patterns cannot be compared with the experiments because the trajectories of air bubbles intersect.

78N18043*# ISSUE 9 PAGE 1110 CATEGORY 5 RPT#: NASA-TM-78459 A-7301-PT-1 78/02/00 102 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Aeromechanical stability of helicopters with a bearingless main rotor. Part 1: Equations of motion
AUTH: A/HODGES, D. H.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A06/MF A01
Prepared in cooperation with Army Aviation Res. and Develop. Command, Moffett Field, Calif.
MAJS: /*AERODYNAMIC STABILITY/*AEROELASTICITY/*EQUATIONS OF MOTION/*HELICOPTER PERFORMANCE/*RIGID ROTORS/*ROTARY WINGS
MINS: / DIFFERENTIAL EQUATIONS/ DYNAMIC STRUCTURAL ANALYSIS/ FLEXIBILITY
ABA: Author
ABS: Equations of motion for a coupled rotor-body system were derived for the purpose of studying air and ground resonance characteristics of helicopters that have bearingless main rotors. For the fuselage, only four rigid body degrees of freedom are considered: longitudinal and lateral translations, pitch, and roll. The rotor is assumed to consist of three or more rigid blades. Each blade is joined to the hub by means of a flexible beam segment (flexbeam or strap). Pitch change is accomplished by twisting the flexbeam with the pitch-control system, the characteristics of which are variable. Thus, the analysis is capable of implicitly treating aeroelastic couplings generated by the flexbeam elastic deflections, the pitch-control system, and the angular offsets of the blade and flexbeam. The linearized equations are written in the nonrotating system retaining only the cyclic rotor modes; thus, they comprise a system of homogeneous

ordinary differential equations with constant coefficients. All contributions to the linearized perturbation equations from inertia, gravity, quasi-steady aerodynamics, and the flexbeam equilibrium deflections are retained exactly.

79A18703*# ISSUE 6 PAGE 949 CATEGORY 8
78/00/00 28 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flight research capabilities of the NASA/Army Rotor Systems Research Aircraft

AUTH: A/WHITE, S., JR.; B/CONDON, G. W. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.); B/(U.S. Army, Research and Technology Laboratories, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Research and Technology Labs., Fort Eustis, Va.

In: European Rotorcraft and Powered Lift Aircraft Forum, 4th, Stresa, Italy, September 13-15, 1978, Proceedings, Volume 2. (A79-18637 06-01) Gallarate, Italy, Costruzioni Aeronautiche Giovanni Agusta S.p.A., 1978, p. 72-0 to 72-27.

MAJS: /*HELICOPTER DESIGN/*MILITARY AIRCRAFT/*NASA PROGRAMS /*RESEARCH AIRCRAFT/*ROTARY WINGS

MINS: / AIRCRAFT CONFIGURATIONS/ CONTROLLABILITY/ CRITICAL LOADING/ HOVERING/ STRUCTURAL VIBRATION

ABA: B.J.

ABS: After a brief description of the Rotor Systems Research Aircraft (RSRA), the paper reviews their flight capabilities and limitations. A favorable assessment is given to the expected research capabilities of the RSRA. The structural limitations should not significantly constrain the flight envelope for research operations; the handling qualities, though not optimum, are within the parameters originally predicted; and there are no fundamental dynamics problems. Although the accuracy of the force and moment measurement system has not yet been quantified by calibration, it is expected to be acceptable after calibration.

79A18674*# ISSUE 6 PAGE 940 CATEGORY 5
78/00/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Recent progress in rotorcraft and powered-lift research

AUTH: A/ROBERTS, L. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

In: European Rotorcraft and Powered Lift Aircraft Forum, 4th, Stresa, Italy, September 13-15, 1978, Proceedings, Volume 2. (A79-18637 06-01) Gallarate, Italy, Costruzioni Aeronautiche Giovanni Agusta S.p.A., 1978, p. 41-0 to 41-18.

MAJS: /*AIRCRAFT DESIGN/*COMPOUND HELICOPTERS/*POWERED LIFT AIRCRAFT/*ROTARY WING AIRCRAFT/*VERTICAL TAKEOFF AIRCRAFT

MINS: / BODY-WING CONFIGURATIONS/ COMMERCIAL AIRCRAFT/ FLIGHT SIMULATORS/ HARRIER AIRCRAFT/ ROTOR BLADES/ ROTOR SYSTEMS RESEARCH AIRCRAFT/ THRUST AUGMENTATION/ TILT ROTOR RESEARCH AIRCRAFT PROGRAM/ WIND TUNNEL TESTS

ABA: B.J.

ABS: The paper reviews some of the recent technological developments in the United States in the field of rotorcraft and powered-lift research, with primary emphasis on the compound helicopter and the augmentor thrust approaches to vertical flight. The last several years have seen significant developments in the state of the art through the combined use of wind tunnels, simulators, and research aircraft. The results of several representative studies are discussed to demonstrate the improvements that have been made in several of the important vehicle-related parameters. The prospect for further advances is also discussed.

79A18185*# ISSUE 5 PAGE 754 CATEGORY 5 RPT#: AHS 78-64 78/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flap-lag-torsion aeroelastic stability of circulation-controlled rotors in hover

AUTH: A/CHOPRA, I.; B/JOHNSON, W. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.); B/(U.S. Army, Aeromechanics Laboratory, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif.

In: American Helicopter Society, Annual National Forum, 34th, Washington, D.C., May 15-17, 1978, Proceedings. (A79-18126 05-01) Washington, D.C., American Helicopter Society, 1978, 15 p.

MAJS: /*AIRCRAFT STABILITY/*ATMOSPHERIC CIRCULATION/*FLAPS (CONTROL SURFACES)/*HELICOPTER CONTROL/*HOVERING/* ROTORCRAFT AIRCRAFT

MINS: / AEROELASTICITY/ HELICOPTER DESIGN/ ROTOR BLADES/ TORSIONAL STRESS/ TRAILING EDGES/ VIBRATION DAMPING

ABA: (Author)

ABS: The results of a theoretical investigation of the flap-lag-torsion stability of circulation controlled rotors in hover are presented. Stability boundaries are presented as a function of thrust and lag frequency, at several levels of blowing coefficient, for flap frequencies of 1.1/rev and 1.8/ rev. The effects of several parameters on the blade flap-lag stability are examined, including structural damping.

structural coupling, pitch-lag and pitch-flap coupling, and the blade feathering motion. The trailing edge blowing can have a major impact on the blade aeroelastic stability, which should be considered in the rotor design. The implications of these results for the current CCR and X-Wing rotorcraft designs are considered.

79A18181*# ISSUE 5 PAGE 754 CATEGORY 5 RPT#: AHS 78-60 78/00/00 20 PAGES UNCLASSIFIED DOCUMENT
UTTL: Wind-tunnel test results of a full-scale multicyclic controllable twist rotor
AUTH: A/MCCLOUD, J. L., III; B/WEISBRICH, A. L. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.); B/(Kaman Aerospace Corp., Bloomfield, Conn.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Kaman Aerospace Corp., Bloomfield, Conn.
In: American Helicopter Society, Annual National Forum, 34th, Washington, D.C., May 15-17, 1978, Proceedings. (A79-18126 05-01) Washington, D.C., American Helicopter Society, 1978. 20 p.
MAJS: /*BENDING MOMENTS/*HELICOPTER CONTROL/*HELICOPTER DESIGN/*ROTARY WINGS/*TWISTED WINGS/*WIND TUNNEL TESTS
MINS: / ACTUATORS/ AERODYNAMIC DRAG/ AERODYNAMIC LOADS/ FLIGHT CONDITIONS/ ROTOR BLADES
ABA: P.T.H.
ABS: Results of wind tunnel testing of a multicyclic controllable twist rotor at several flight conditions and advance ratios of 0.22 and 0.33 are evaluated. It is found that blade flatwise bending moments and root control actuator loads (fixed system) can be reduced with multicyclic control. Flatwise bending moment reductions of 22-30% with concurrent 83% reductions in control loads were predicted. Analysis of profile power changes indicates a decrease in profile power coefficient of 0.00016, corresponding to a loss of 0.12 sq m of equivalent drag area.

79A18155*# ISSUE 5 PAGE 757 CATEGORY 8 RPT#: AHS 78-29 78/00/00 23 PAGES UNCLASSIFIED DOCUMENT
UTTL: A piloted simulator investigation of augmentation systems to improve helicopter nap-of-the-earth handling qualities
AUTH: A/CHEN, R. T. N.; B/TALBOT, P. D.; C/GERDES, R. M.; D/DUGAN, D. C. PAA: D/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
In: American Helicopter Society, Annual National Forum, 34th, Washington, D.C., May 15-17, 1978, Proceedings. (A79-18126 05-01) Washington, D.C., American Helicopter Society, 1978. 23 p.
MAJS: /*CONTROLLABILITY/*FLIGHT SIMULATION/*HELICOPTER CONTROL/*STABILITY AUGMENTATION/*TERRAIN FOLLOWING AIRCRAFT
MINS: / ATTITUDE CONTROL/ FEEDBACK CONTROL/ HELICOPTER DESIGN/ HELICOPTER PERFORMANCE/ PILOT PERFORMANCE/ RIGID ROTORS/ ROTARY WINGS/ SYSTEMS ENGINEERING
ABA: (Author)
ABS: A piloted simulation study assessed various levels of stability and control augmentation designed to improve the handling qualities of several helicopters in nap-of-the-earth (NOE) flight. Five basic single rotor helicopters - one teetering, two articulated, and two hingeless - which were found to have a variety of major deficiencies in a previous fixed-based simulator study were selected as baseline configurations. The stability and control augmentation systems (SCAS) include simple control augmentation systems (CAS) to decouple pitch and yaw responses due to collective input and to quicken the pitch and roll control responses; SCAS of rate command type designed to optimize the sensitivity and damping and to decouple the pitch-roll due to aircraft angular rate; and attitude command type SCAS. Pilot ratings and commentary are presented as well as performance data related to the task. SCAS control usage and their gain levels associated with specific rotor type are also discussed.

79A18153*# ISSUE 5 PAGE 757 CATEGORY 8 RPT#: AHS 78-27 78/00/00 16 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analytical design of a high performance stability and control augmentation system for a hingeless rotor helicopter
AUTH: A/MIYAJIMA, K. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
In: American Helicopter Society, Annual National Forum, 34th, Washington, D.C., May 15-17, 1978, Proceedings. (A79-18126 05-01) Washington, D.C., American Helicopter Society, 1978. 16 p.
MAJS: /*AIRCRAFT STABILITY/*HELICOPTER CONTROL/*HELICOPTER DESIGN/*RIGID ROTORS/*STABILITY AUGMENTATION
MINS: / CONTROLLABILITY/ EIGENVALUES/ EQUATIONS OF MOTION/ FEEDBACK CONTROL/ LEAST SQUARES METHOD/ LINEAR SYSTEMS / OPTIMAL CONTROL
ABA: (Author)
ABS: A stability and control augmentation system (SCAS) was designed based on a set of comprehensive performance criteria. Linear optimal control theory was applied to determine appropriate feedback gains for the stability augmentation system (SAS). The helicopter was

represented by six-degree-of-freedom rigid body equations of motion and constant factors were used as weightings for state and control variables. The ratio of these factors was employed as a parameter for SAS analysis and values of the feedback gains were selected on this basis to satisfy three of the performance criteria for full and partial state feedback systems. A least squares design method was then applied to determine control augmentation system (CAS) cross feed gains to satisfy the remaining seven performance criteria. The SCAS gains were then evaluated by nine degree-of-freedom equations which include flapping motion and conclusions drawn concerning the necessity of including the pitch/regressing and roll/regressing modes in SCAS analyses.

79A18129*# ISSUE 5 PAGE 744 CATEGORY 2 RPT#: AHS 78-03 78/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Full-scale wind tunnel test of a modern helicopter main rotor - Investigation of tip Mach number effects and comparisons of four tip shapes

AUTH: A/STROUB, R. H. PAA: A/(NASA. Ames Research Center; U.S. Army, Aeromechanics Laboratory, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Research and Technology Labs., Moffett Field, Calif.
In: American Helicopter Society, Annual National Forum, 34th, Washington, D.C., May 15-17, 1978. Proceedings. (A79-18126 05-01) Washington, D.C., American Helicopter Society, 1978. 7 p.

MAJS: /*BLADE TIPS/*HELICOPTER PERFORMANCE/*ROTARY WINGS/*TIP SPEED/*WIND TUNNEL TESTS/*WING PLANFORMS

MINS: / AEROACOUSTICS/ MACH NUMBER/ RECTANGULAR WINGS/ ROTOR AERODYNAMICS/ SWEPT WINGS/ TRAPEZOIDAL WINGS

ABA: (Author)

ABS: A test of a full-scale helicopter rotor was conducted in the NASA Ames Research Center 40- by 80-Foot Wind Tunnel to investigate performance characteristics of rotors with various tip geometries. Four blade tip geometries were investigated: rectangular, trapezoidal, swept rectangular, and swept trapezoidal. The investigation was accomplished over an advance ratio range of 0.2 to 0.375 and an advancing blade Mach number range from 0.72 up to 0.97. On a power basis, the best overall tip geometry was the swept trapezoidal configuration.

78A16694*# ISSUE 4 PAGE 540 CATEGORY 5
77/12/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Tilt-proprotor perspective --- VTOL aircraft characteristics and development

AUTH: A/FEW, D. D.; B/EDENBOROUGH, H. K. PAA: B/(NASA, Ames Research Center, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
Astronautics and Aeronautics, vol. 15, Dec. 1977. p. 28-31.

MAJS: /*AIRCRAFT DESIGN/*TILT ROTOR AIRCRAFT/*VERTICAL TAKEOFF AIRCRAFT

MINS: / AIRCRAFT CONTROL/ AIRCRAFT ENGINES/ CRUISING FLIGHT/ DYNAMIC STABILITY/ F-4 AIRCRAFT/ FLIGHT SIMULATION/ HOVERING/ RESEARCH AND DEVELOPMENT/ ROTARY WINGS/ THRUST CONTROL

ABA: P.T.H.

ABS: The general tilt-proprotor concept is discussed, and a more detailed look at the XV-15 aircraft is taken. The special features of the two-engine system, engine control system, and flight control system are mentioned. The main objectives of the XV-15 program are to (1) verify rotor/pylon/wing/dynamic stability and aircraft performance over a representative operational envelope, (2) assess the handling qualities and establish a safe operating envelope, and (3) investigate gust sensitivity, effects of downwash, and hover operation. With regard to rotor/pylon stability, one challenge is to be able to predict a parameter's value and then build hardware to match. The analytical program has gained some respect through aeroelastic and full-scale XV-3 demonstrations. Special concern centers around the thrust and power management system when flying at high speed when very small changes in rotor collective pitch represent large changes in thrust and power. Demonstration of the system awaits wind-tunnel and flight testing.

78A16693*# ISSUE 4 PAGE 531 CATEGORY 1
77/12/00 2 PAGES UNCLASSIFIED DOCUMENT

UTTL: Moving V/STOL from technology to system

AUTH: A/DECKERT, W. H. PAA: A/(NASA, Ames Research Center, V/STOL Aircraft Technology Div., Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
Astronautics and Aeronautics, vol. 15, Dec. 1977. p. 26, 27.

MAJS: /*AIRCRAFT DESIGN/*TECHNOLOGY ASSESSMENT/*V/STOL AIRCRAFT

MINS: / ARMED FORCES (UNITED STATES)/ FIGURE OF MERIT/ HELICOPTERS/ MILITARY AIRCRAFT/ SYSTEMS ANALYSIS

ABA: P.T.H.

ABS: The design of future V/STOL aircraft is seen to revolve around tradeoffs of V/STOL capability with classical figures of merit. The Navy may soon drive V/STOL technology to the threshold of a major advancement. It has decided to proceed with a significant V/STOL effort and, based on results, decide whether or not to procure significant numbers and types of V/STOL aircraft. The author envisages a line of development beginning with Navy Type A multipurpose subsonic V/STOL aircraft, followed by derivatives for civil utility applications, followed ultimately by V/STOL commercial transports.

78A23804* ISSUE 8 PAGE 1319 CATEGORY 5 RPT#: SAE PAPER 770953 77/11/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: XV-15 tilt rotor test - Progress report

AUTH: A/BROWN, J. H., JR.; B/EDENBOROUGH, H. K.; C/FEW, D. D. PAA: B/(U.S. Army, Aviation Research and Development Command, Moffett Field, Calif.); C/(NASA, Ames Research Center, V/STOL Aircraft Technology Div., Moffett Field, Calif.)

CORP: Army Aviation Research and Development Command, Moffett Field, Calif.; National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

Society of Automotive Engineers, Aerospace Meeting, Los Angeles, Calif., Nov. 14-17, 1977, 10 p.

MAJS: /*AIRCRAFT PERFORMANCE/*FLIGHT TESTS/*TILT ROTOR AIRCRAFT/*VERTICAL TAKEOFF AIRCRAFT/*XV-15 AIRCRAFT

MINS: / AIRCRAFT DESIGN/ HELICOPTER PERFORMANCE/ TURBOPROP ENGINES

ABA: (Author)

ABS: In a continuing effort to expand the versatility of their aircraft, VTOL designers have for many years tried to combine the desirable features of various concepts into a single aircraft. This is a formidable task and most efforts have met with limited success. This paper explores the need for an aircraft combining the efficient VTOL capability of a helicopter with the efficient high speed characteristics of a fixed wing turboprop. The ability of the tilt rotor concept to fill this requirement and examples as to its potential usefulness in both military and civil missions is discussed. The history of the concept and the status of the current Army/NASA/Bell XV-15 program and its role in proving the viability of the concept are reviewed.

78N10002*# ISSUE 1 PAGE 1 CATEGORY 1 RPT#: NASA-TM-78443 A-7227 77/09/00 40 PAGES UNCLASSIFIED DOCUMENT

UTTL: Calculated hovering helicopter flight dynamics with a circulation controlled rotor

AUTH: A/JOHNSON, W.; B/CHOPRA, I.

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; Army Aviation Research and Development Command, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01

Prepared in cooperation with Army Aviat. Res. and Develop. Command, Moffett Field, Calif.

MAJS: /*AERODYNAMICS/*FLIGHT CHARACTERISTICS/*HELICOPTER CONTROL/*ROTARY WINGS

MINS: / CIRCULATION/ HELICOPTER PERFORMANCE/ HOVERING STABILITY/ ROTOR LIFT/ ROTOR SPEED

ABA: Author

ABS: The influence of the rotor blowing coefficient on the calculated roots of the longitudinal and lateral motion was examined for a range of values of the rotor lift and the blade flap frequency. The control characteristics of a helicopter with a circulation controlled rotor are discussed. The principal effect of the blowing is a reduction in the rotor speed stability derivative. Above a critical level of blowing coefficient, which depends on the flap frequency and rotor lift, negative speed stability is produced and the dynamic characteristics of the helicopter are radically altered.

77N32078*# ISSUE 23 PAGE 3024 CATEGORY 2 RPT#: NASA-TM-78434 77/09/00 30 PAGES UNCLASSIFIED DOCUMENT

UTTL: Effects of unsteady aerodynamics on rotor aeroelastic stability

AUTH: A/KUNZ, D. L.

CORP: National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC A02/MF A01

Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.

MAJS: /*AERODYNAMIC STABILITY/*AEROELASTICITY/*ROTOR BLADES /*WING OSCILLATIONS

MINS: / AERODYNAMIC FORCES/ EQUATIONS OF MOTION/ HELICOPTERS / VIBRATION DAMPING

ABA: Author

ABS: The effects of unsteady aerodynamics on the stability characteristics of helicopter rotor blades were studied. A simple physical model of each blade was used together with Theodorsen, Loewy, and quasi-steady aerodynamics to derive the equations of motion. The stability analysis comparing the effects of using each

of the three theories revealed some significant differences between the Loewy and Theodorsen results. These included increases and decreases in lead-lag damping, localized around integer lead-lag frequencies. It was also shown that the standard method of multi-blade coordinates must be modified for use in conjunction with Loewy aerodynamics.

77N31174*# ISSUE 22 PAGE 2900 CATEGORY 8 RPT#: NASA-TM-73258 A-7097 77/08/00 46 PAGES
UNCLASSIFIED DOCUMENT

UTTL: A failure effects simulation of a low authority flight control augmentation system on a UH-1H helicopter
AUTH: A/CORLISS, L. D.: B/TALBOT, P. D.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01
Prepared in cooperation with USAAMRDL, Moffett Field, Calif.
MAJS: /*FLIGHT CONTROL/*HELICOPTER CONTROL/*MALFUNCTIONS/*SERVOCONTROL/*SYSTEM FAILURES/*UH-1 HELICOPTER
MINS: / AUGMENTATION/ AUTOMATIC CONTROL/ FLIGHT SAFETY/ MATHEMATICAL MODELS/ SIMULATORS
ABA: Author
ABS: A two-pilot moving base simulator experiment was conducted to assess the effects of servo failures of a flight control system on the transient dynamics of a Bell UH-1H helicopter. The flight control hardware considered was part of the V/STOLAND system built with control authorities of from 20-40%. Servo hardover and oscillatory failures were simulated in each control axis. Measurements were made to determine the adequacy of the failure monitoring system time delay and the servo center and lock time constant, the pilot reaction times, and the altitude and attitude excursions of the helicopter at hover and 60 knots. Safe recoveries were made from all failures under VFR conditions. Pilot reaction times were from 0.5 to 0.75 sec. Reduction of monitor delay times below these values resulted in significantly reduced excursion envelopes. A subsequent flight test was conducted on a UH-1H helicopter with the V/STOLAND system installed. Series servo hardovers were introduced in hover and at 60 knots straight and level. Data from these tests are included for comparison.

77N28525*# ISSUE 19 PAGE 2543 CATEGORY 39 RPT#: NASA-TN-D-8515 A-6740 77/07/00 253 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Aeroelastic analysis for rotorcraft in flight or in a wind tunnel
AUTH: A/JOHNSON, W.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC A12/MF A01
Washington Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
MAJS: /*AEROELASTICITY/*ROTORCRAFT AIRCRAFT/*WIND TUNNEL TESTS
MINS: / AERODYNAMIC DRAG/ DESIGN ANALYSIS/ EQUATIONS OF MOTION
ABA: Author
ABS: An analytical model is developed for the aeroelastic behavior of a rotorcraft in flight or in a wind tunnel. A unified development is presented for a wide class of rotors, helicopters, and operating conditions. The equations of motion for the rotor are derived using an integral Newtonian method, which gives considerable physical insight into the blade inertial and aerodynamic forces. The rotor model includes coupled flap-lag bending and blade torsion degrees of freedom, and is applicable to articulated, hingeless, gimballed, and teetering rotors with an arbitrary number of blades. The aerodynamic model is valid for both high and low inflow, and for axial and nonaxial flight. The rotor rotational speed dynamics, including engine inertia and damping, and the perturbation inflow dynamics are included For a rotor on a wind-tunnel support, a normal mode representation of the test module, strut, and balance system is used. The aeroelastic analysis for the rotorcraft in flight is applicable to a general two-rotor aircraft, including single main-rotor and tandem helicopter configurations, and side-by-side or tilting proprotor aircraft configurations.

77N27105*# ISSUE 18 PAGE 2349 CATEGORY 5 RPT#: NASA-TM-73262 A-7115 77/06/00 29 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Calculated dynamic characteristics of a soft-inplane hingeless rotor helicopter
AUTH: A/JOHNSON, W.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01
Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.

MAJS: /*DYNAMIC CHARACTERISTICS/*HELICOPTER DESIGN/*RIGID ROTORS
MINS: / AERODYNAMIC STABILITY/ AEROELASTICITY/ FLIGHT CHARACTERISTICS
ABA: Author
ABS: Calculated dynamic characteristics of a representative soft-inplane hingeless rotor helicopter are presented. The flight dynamics as a function of speed and gross weight are given. The requirements for accurate analytical modelling of this helicopter are established. The influence of the horizontal tail size, the rotor precone, the blade sweep, and the blade center of gravity/aerodynamic center offset on the calculated flight dynamics and aeroelastic stability are examined. The calculations show no evidence of an air resonance stability problem with this aircraft.

77N26067*# ISSUE 17 PAGE 2209 CATEGORY 1 RPT#: NASA-TM-X-73244 A-7047 77/05/00 33 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter optimal descent and landing after power loss
AUTH: A/JOHNSON, W.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01
Sponsored in part by Army
MAJS: /*DESCENT PROPULSION SYSTEMS/*HELICOPTER PERFORMANCE/* OPTIMAL CONTROL/*VERTICAL LANDING
MINS: / FLIGHT TESTS/ HELICOPTER DESIGN/ HOVERING/ VERTICAL FLIGHT
ABA: Author
ABS: An optimal control solution is obtained for the descent and landing of a helicopter after the loss of power in level flight. The model considers the helicopter vertical velocity, horizontal velocity, and rotor speed; and it includes representations of ground effect, rotor inflow time lag, pilot reaction time, rotor stall, and the induced velocity curve in the vortex ring state. The control (rotor thrust magnitude and direction) required to minimize the vertical and horizontal velocity at contact with the ground is obtained using nonlinear optimal control theory. It is found that the optimal descent after power loss in hover is a purely vertical flight path. Good correlation, even quantitatively, is found between the calculations and (non-optimal) flight test results.

77N25086*# ISSUE 16 PAGE 2075 CATEGORY 2 RPT#: NASA-TM-X-73238 A-7071 77/05/00 158 PAGES UNCLASSIFIED DOCUMENT
UTTL: Laser velocimeter measurements of two-bladed helicopter rotor flow fields
AUTH: A/BIGGERS, J. C.; B/LEE, A.; C/ORLOFF, K. L.; D/LEMMER, O. J. PAA: B/(AAMRDL, Moffett Field, Calif.); D/(Beam Eng. Inc.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A08/MF A01
MAJS: /*FLOW DISTRIBUTION/*LASER DOPPLER VELOCIMETERS/* ROTARY WING AIRCRAFT
MINS: / FLOW MEASUREMENT/ HELICOPTERS/ MINICOMPUTERS/ WIND TUNNEL TESTS
ABA: Author
ABS: Data from a wind tunnel investigation of the flow fields around helicopter rotors were presented. A two component laser velocimeter was used to measure the velocity fields of two 2.1 m diameter rotors. A minicomputer-based online data system is described which monitored, reduced, and plotted the results. Tip vortices constitute the primary disturbances in the flow field, but present theories do not predict vortex positions and velocity distributions with sufficient accuracy.

77A24939*# ISSUE 10 PAGE 1565 CATEGORY 8 77/03/00 8 PAGES UNCLASSIFIED DOCUMENT
UTTL: Optimal control alleviation of tilting proprotor gust response
AUTH: A/JOHNSON, W. PAA: A/(NASA, Ames Research Center, Large Scale Aerodynamics Branch; U.S. Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif.)
CORP: Army Air Mobility Research and Development Lab., Moffett Field, Calif.; National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
Journal of Aircraft, vol. 14, Mar. 1977, p. 301-308.
MAJS: /*AEROELASTICITY/*GUST ALLEVIATORS/*OPTIMAL CONTROL/* ROTOR AERODYNAMICS/*TILT ROTOR AIRCRAFT/*TILTED PROPELLERS
MINS: / AERODYNAMIC LOADS/ AERODYNAMIC STABILITY/ CONTROL THEORY/ CONTROLLABILITY/ CONTROLLERS/ KALMAN FILTERS/ ROTOR SPEED/ SYSTEMS ENGINEERING
ABA: (Author)
ABS: Optimal control theory is applied to the design of a control system for alleviation of the gust response of tilting proprotor aircraft. Using a proprotor and cantilever wing analytical model, the uncontrolled and controlled gust response is examined over the entire operating range of the aircraft except for hover.

helicopter mode, conversion, and airplane mode flight. Substantial improvements in the loads, ride quality, and aeroelastic stability are possible with a properly designed controller. A single controller, nominally optimal only at the design point speed (160 knots here), operated efficiently over the entire speed range, with the possible exception of very low speed in helicopter mode. Kalman-Bucy filters were used as compensation networks to provide state estimates from various measurements in the system. Efficient control requires the measurement of the wing motion, rotor speed perturbation, and tip-path-plane tilt.

77A30006* ISSUE 12 PAGE 1948 CATEGORY 3
77/02/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Directions in civil aviation 1980-2000
AUTH: A/ROBERTS, L. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
Acta Astronautica, vol. 4, Jan.-Feb. 1977, p. 7-14.
MAJS: /*AIR TRANSPORTATION/*AIRCRAFT DESIGN/*CIVIL AVIATION /*TECHNOLOGICAL FORECASTING
MINS: /COMMERCIAL AIRCRAFT/ GENERAL AVIATION AIRCRAFT/ HYPERSONIC AIRCRAFT/ PASSENGER AIRCRAFT/ RESEARCH AND DEVELOPMENT/ SUBSONIC AIRCRAFT/ SUPERSONIC AIRCRAFT
ABA: B.J.
ABS: The following future directions in civil aviation are considered: (1) greater economy and efficiency in passenger and cargo air service at subsonic speeds, and improved utility and safety for general aviation, (2) greatly improved short haul air transportation using turbofan or turboprop aircraft, and subsequently, rotorcraft and V/STOL aircraft, and (3) supersonic, and ultimately hypersonic, air transportation for transoceanic long range flight. Attention is also given to new directions in research and technology.

79A14971* ISSUE 4 PAGE 543 CATEGORY 8 77/00/00
6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Design and evaluation of flight directors for V/STOL aircraft
AUTH: A/HESS, R. A. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
In: Conference on Decision and Control, and Symposium on Adaptive Processes, 16th, and Special Symposium on Fuzzy Set Theory and Applications, New Orleans, La., December 7-9, 1977. Proceedings. Volume 1. (A79-14957 04-63) Piscataway, N.J., Institute of Electrical and Electronics Engineers, Inc., 1977, p. 241-246.
MAJS: /*AIRCRAFT CONTROL/*COMPENSATORY TRACKING/*CONTROLLERS /*OPTIMAL CONTROL/*SYSTEMS ENGINEERING/*V/STOL AIRCRAFT
MINS: / AIRCRAFT LANDING/ AIRCRAFT MANEUVERS/ APPROACH CONTROL/ DESIGN ANALYSIS/ DISPLAY DEVICES/ HELICOPTER CONTROL/ LONGITUDINAL CONTROL/ PILOT PERFORMANCE/ STABILITY AUGMENTATION/ TRANSFER FUNCTIONS
ABA: (Author)
ABS: A brief review of model-based techniques for the design of aircraft flight directors is undertaken. An analytical director design technique which utilizes an optimal control model of the human pilot is then discussed in more detail. The analytical and experimental results of three specific director design studies are discussed, all involving control of a light utility helicopter. Finally, a general design methodology is discussed which can aid in the specification of pilot-centered display requirements.

77A40087** ISSUE 18 PAGE 3003 CATEGORY 5 RPT#: AHS 77-33-64 77/00/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Status report on XV-15 Tilt Rotor Test Program
AUTH: A/BROWN, J. H., JR.; B/EDENBOROUGH, H. K. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.); B/(U.S. Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif.
In: American Helicopter Society, Annual National Forum, 33rd, Washington, D.C., May 9-11, 1977. Proceedings. (A77-40048 18-01) Washington, D.C., American Helicopter Society, Inc., 1977, 13 p.
MAJS: /*PERFORMANCE TESTS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*XV-15 AIRCRAFT
MINS: / AIRCRAFT DESIGN/ ENGINE TESTS/ FABRICATION/ FATIGUE TESTS/ FLIGHT TESTS/ LOAD TESTS/ PROJECT MANAGEMENT/ RESEARCH AND DEVELOPMENT/ STABILITY AUGMENTATION/ TRANSMISSIONS (MACHINE ELEMENTS)/ VIBRATION TESTS/ WIND TUNNEL TESTS
ABA: (Author)
ABS: The XV-15 Tilt Rotor Research Aircraft Program has progressed from the design and fabrication stage to the test phase and is now beginning that portion of the program which will culminate in the determination of the viability of this promising concept. This paper will review the joint Army/NASA/Bell Helicopter Textron (BHT) XV-15 program as it currently stands, including the results of the experience gained during the design and fabrication phases and testing to date.

Highlights of the overall Tilt Rotor Program will be discussed exploring the potential of this concept to result in a new generation of highly productive VTOL systems.

77A40061*# ISSUE 18 PAGE 3002 CATEGORY 5 RPT#: AHS 77-33-17 77/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: A review of advanced rotor research --- in helicopter development

AUTH: A/KELLY, M. W.; B/RABBOTT, J. P. PAA: A/(NASA, Ames Research Center, Large-Scale Aerodynamics Branch, Moffett Field, Calif.); B/(U.S. Army Air Mobility Research and Development Laboratory, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif.

In: American Helicopter Society, Annual National Forum, 33rd, Washington, D.C., May 9-11, 1977. Proceedings. (A77-40048 18-01) Washington, D.C., American Helicopter Society, Inc., 1977. 9 p.

MAJS: /*HELICOPTER DESIGN/*ROTARY WINGS/*TECHNOLOGY ASSESSMENT

MINS: / COMPOSITE STRUCTURES/ DYNAMIC LOADS/ HELICOPTER PERFORMANCE/ RESEARCH AND DEVELOPMENT/ VARIABLE GEOMETRY STRUCTURES

ABA: B.J.

ABS: This paper reviews advanced-rotor concepts including the advancing blade concept, the circulation control rotor, the X-wing rotor, the variable diameter rotor, the hingeless tilt rotor, the bearingless main rotor, the composite structures rotor, the variable geometry rotor, the multicyclic controllable pitch rotor, the multicyclic controllable twist rotor, and the live twist rotor. The rotor concepts are discussed in terms of performance (cruise speed, and lift/drag ratio) and dynamic loads and vibration.

77A40054*# ISSUE 18 PAGE 2998 CATEGORY 2 RPT#: AHS 77-33-06 77/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Measurements of helicopter rotor tip vortices

AUTH: A/BIGGERS, J. C.; B/ORLOFF, K. L.; C/LEE, A.; D/LEMMER, O. J. PAA: B/(NASA, Ames Research Center, Moffett Field, Calif.); C/(Beam Engineering, Inc., Sunnyvale, Calif.); D/(U.S. Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Beam Engineering, Inc., Sunnyvale, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif.

In: American Helicopter Society, Annual National Forum, 33rd, Washington, D.C., May 9-11, 1977. Proceedings. (A77-40048 18-01) Washington, D.C., American Helicopter Society, Inc., 1977. 12 p.

MAJS: /*BLADE TIPS/*HELICOPTER PERFORMANCE/*ROTARY WINGS/*VELOCITY MEASUREMENT/*VORTICES

MINS: / FLOW MEASUREMENT/ LASER DOPPLER VELOCIMETERS/ VELOCITY DISTRIBUTION/ WIND TUNNEL TESTS

ABA: (Author)

ABS: This paper presents results from a recent wind-tunnel investigation of model helicopter rotor tip vortices. Measurements were made of the vortex positions, core sizes, and velocity distributions. A laser velocimeter was used to make the measurements, and a minicomputer-based data system was used to process the data and to aid in controlling the experiment. The velocimeter, the data system, and the software developed for the minicomputer are briefly described. The rotors investigated were two-bladed, teetering rotors with diameters of 2.1 m. Two sets of blades were used, one set with zero twist and one set with -11 deg of linear twist. The vortex positions were obtained by making flow field traverses while strobing the data system at a fixed azimuth. Aging of a vortex element was also studied by following the convected element while strobing the data system at different azimuths. By this method, the effects on the vortex of a close interaction with a blade and another vortex were studied.

77A34944*# ISSUE 15 PAGE 2470 CATEGORY 9 RPT#: AIAA 77-587 77/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Improving large-scale testing capability by modifying the 40- by 80-foot wind tunnel

AUTH: A/MORT, K. W.; B/SODERMAN, P. T.; C/ECKERT, W. T. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.); C/(U.S. Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif.

In: V/STOL Conference, Palo Alto, Calif., June 6-8, 1977, Technical Papers. (A77-34926 15-05) New York, American Institute of Aeronautics and Astronautics, Inc., 1977. p. 134-140.

MAJS: /*FULL SCALE TESTS/*POWERED LIFT AIRCRAFT/*SUBSONIC WIND TUNNELS/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC CHARACTERISTICS/ GROUND EFFECT

(AERODYNAMICS)/ ROTARY WING AIRCRAFT/ SCALE MODELS/ SUBSONIC AIRCRAFT/ WIND TUNNEL DRIVES

ABA: (Author)

ABS: Interagency studies conducted during the last several years have indicated the need to improve full-scale testing capabilities. The studies showed that the most effective trade between test capability and facility cost was provided by repowering the existing Ames Research Center 40- by 80-foot wind tunnel to increase the maximum speed from about 100 m/s (200 knots) to about 150 m/s (300 knots) and by adding a new 24- by 37-m (80- by 120-ft) test section powered for about a 50-m/s (100-knot) maximum speed. This paper reviews the design of the facility, a few of its test capabilities, and some of its unique features.

77N17029* ISSUE 8 PAGE 978 CATEGORY 5 RPT#: NASA-CASE-ARC-10807-1 US-PATENT-3,999,886 US-PATENT-APPL-SN-513612 US-PATENT-CLASS-416-104 US-PATENT-CLASS-416-141 US-PATENT-CLASS-416-138 76/12/28 11 PAGES UNCLASSIFIED DOCUMENT Filed 10 Oct. 1974 Supersedes N74-34475 (12 - 24, p 2899)

UTTL: Hingeless helicopter rotor with improved stability TLSP: Patent

AUTH: A/ORMISTON, R. A.; B/BOUSMAN, W. G.; C/HODGES, D. H.; D/PETERS, D. A. PAT: D/inventors (to NASA)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. SAP: Avail: US Patent Office

MAJS: /*AERODYNAMIC STABILITY/*HELICOPTERS/*INCLINATION/* RIGID ROTORS/*ROTARY WINGS

MINS: / AEROELASTICITY/ CONSTRUCTION MATERIALS/ PATENTS/ STRUCTURAL STABILITY

ABA: Official Gazette of the U.S. Patent Office

ABS: Improved stability was provided in a hingeless helicopter rotor by inclining the principal elastic flexural axes and coupling pitching of the rotor blade with the lead-lag bending of the blade. The primary elastic flex axes were inclined by constructing the blade of materials that display non-uniform stiffness, and the specification described various cross section distributions and the resulting inclined flex axes. Arrangements for varying the pitch of the rotor blade in a predetermined relationship with lead-lag bending of the blade, i.e., bending of the blade in a plane parallel to its plane of rotation were constructed.

77A28223* ISSUE 11 PAGE 1748 CATEGORY 1 RPT#: SAE PAPER 760928 76/11/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Technology outlook for aviation

AUTH: A/ROBERTS, L. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
Society of Automotive Engineers, Aerospace Engineering and Manufacturing Meeting, San Diego, Calif., Nov. 29-Dec. 2, 1976., 11 p.

MAJS: /*AIR TRANSPORTATION/*AIRCRAFT DESIGN/*CIVIL AVIATION /*TECHNOLOGICAL FORECASTING

MINS: / AIRCRAFT CONFIGURATIONS/ HELICOPTER DESIGN/ ROTARY WINGS/ V/STOL AIRCRAFT

ABA: R.D.V.

ABS: Growth projections for aviation technology are put forth for a quarter-century ahead. Three main trends envisaged are towards: great efficiency and economy and longer range and endurance for subsonic aircraft; new generations of short-range fixed-wing craft and rotorcraft with versatile applicability; supersonic and hypersonic speeds. Improvements in lift/drag ratio, specific fuel consumption, structural weight factor, aerodynamic improvements (laminar flow control, increased wing aspect ratio, drag reduction for specified lift, propulsion efficiency, higher bypass ratios, composite structures) are discussed along with V/STOL, controllable twist rotors, circulation control rotors, variable-cycle engines, and higher structural efficiencies.

76A47686* ISSUE 24 PAGE 3750 CATEGORY 5 RPT#: AIAA PAPER 76-931 76/09/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Review of V/STOL lift/cruise fan technology

AUTH: A/ROLLS, L. S.; B/QUIGLEY, H. C.; C/PERKINS, R. G., JR. PAA: B/(NASA, Ames Research Center, Moffett Field, Calif.); C/(U.S. Navy, Air Systems Command, Washington, D.C.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Naval Air Systems Command, Washington, D. C.
American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Dallas, Tex., Sept. 27-29, 1976, 12 p.

MAJS: /*AIRCRAFT DESIGN/*AIRCRAFT PERFORMANCE/*LIFT FANS/* PROPULSION SYSTEM PERFORMANCE/*V/STOL AIRCRAFT/*WIND TUNNEL TESTS

MINS: / HELICOPTER PERFORMANCE/ JET AIRCRAFT/ LOW SPEED/ PROPULSION SYSTEM CONFIGURATIONS/ TECHNOLOGY ASSESSMENT/ THRUST VECTOR CONTROL/ TURBOFAN AIRCRAFT

ABA: (Author)

ABS: This paper presents an overview of supporting technology programs conducted to reduce the risk in the joint NASA/Navy Lift/Cruise Fan Research and Technology Aircraft Program. The aeronautical community has endeavored to combine the low-speed and lifting capabilities of the helicopter with the high-speed capabilities of the jet aircraft; recent developments have indicated a lift/cruise fan propulsion system may provide these desired characteristics. NASA and the Navy have formulated a program that will provide a research and technology aircraft to furnish viability of the lift/cruise fan aircraft through flight experiences and obtain data on designs for future naval and civil V/STOL aircraft. The supporting technology programs discussed include: (1) design studies for operational aircraft, a research and technology aircraft, and associated propulsion systems; (2) wind-tunnel tests of several configurations; (3) propulsion-system thrust vectoring tests; and (4) simulation. These supporting technology programs have indicated that a satisfactory research and technology aircraft program can be accomplished within the current level of technology.

76A40036* ISSUE 19 PAGE 2913 CATEGORY 5
76/07/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: A note on correlation description --- rotorcraft flight simulation

AUTH: A/MCCLOUD, J. L., III PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

American Helicopter Society, Journal, vol. 21, July 1976, p. 37-39.

MAJS: /*CORRELATION/*FLIGHT SIMULATION/*Q FACTORS/*ROTARY WING AIRCRAFT/*ROTOR LIFT

MINS: / ALGORITHMS/ HARMONIC ANALYSIS/ PHASE SHIFT/ STATISTICAL CORRELATION/ WAVEFORMS

ABA: B.J.

ABS: The paper suggests some modifications to definitions of correlation functions made by Freeman and Bennett (1974) specifically for comparing measured quantities with those predicted by rotor theories, with reference to rotorcraft flight simulation. Special attention is paid to the quality of correlation, determined by a quality factor relating the measured and computed entities. Correlation criteria (mean load and rotor performance, overall amplitude and phase, harmonic altitude and harmonic phase) are examined, along with phase angle correlation criteria (harmonic phase defined by sine-cosine relation and harmonic phase defined by a first positive peak rotor azimuth position)

76N33129*# ISSUE 24 PAGE 3087 CATEGORY 1 RPT#: NASA-TM-X-73161 A-6717 76/06/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: Elementary applications of a rotorcraft dynamic stability analysis

AUTH: A/JOHNSON, W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $3.50

Prepared in cooperation with Army Air Mobility Research and Development Lab., Moffett Field, Calif.

MAJS: /*DYNAMIC STABILITY/ HELICOPTER PERFORMANCE/*ROTARY WING AIRCRAFT/*ROTOR AERODYNAMICS

MINS: / AEROELASTICITY/ FLAPPING/ VARIABLE PITCH PROPELLERS

ABA: Author

ABS: A number of applications of a rotorcraft aeroelastic analysis are presented to verify that the analysis encompasses the classical solutions of rotor dynamics, and to examine the influence of certain features of the model. Results are given for the following topics: flapping frequency response to pitch control; forward flight flapping stability; pitch/flap flutter and divergence; ground resonance instability; and the flight dynamics of several representative helicopters.

76N30148*# ISSUE 21 PAGE 2679 CATEGORY 1 RPT#: NASA-TM-X-73158 A-6700 76/06/00 56 PAGES UNCLASSIFIED DOCUMENT

UTTL: Predicted dynamic characteristics of the XV-15 tilting proprotor aircraft in flight and in the 40- by 80-ft. wind tunnel

AUTH: A/JOHNSON, W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC $4.50

MAJS: /*AERODYNAMIC CHARACTERISTICS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL STABILITY TESTS

MINS: / AEROELASTICITY/ FLIGHT CONTROL/ PERFORMANCE PREDICTION/ TILTING ROTORS

ABA: Author

ABS: Pretest predictions of the dynamic characteristics of the XV-15 tilting proprotor aircraft are presented. The data for the aircraft in flight include: trim conditions, flight dynamics, gust response, aeroelastic stability and the wing response to control. The data for the aircraft in the Ames 40- by 80-ft wind tunnel include aeroelastic stability and the wing response to control. The calculations were made for pylon tilt angles of 0 deg (airplane mode), 0.1 deg (pylon unlocked), 30, 60, and 90 deg (helicopter mode).

76N29268*# ISSUE 20 PAGE 2562 CATEGORY 9 RPT#: NASA-TM-X-73153 A-6692 76/06/00 18 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Analytical models for rotor test module, strut, and balance frame dynamics in the 40 by 80 ft wind tunnel

AUTH: A/JOHNSON, W.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $3.50
Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*ROTARY WINGS/*WIND TUNNEL APPARATUS/*WIND TUNNEL TESTS

MINS: / AEROELASTICITY/ DIFFERENTIAL EQUATIONS/ EQUATIONS OF MOTION/ FRAMES/ HELICOPTERS/ MATHEMATICAL MODELS/ STRUCTURAL VIBRATION/ STRUTS

ABA: Author

ABS: A mathematical model is developed for the dynamics of a wind tunnel support system consisting of a balance frame, struts, and an aircraft or test module. Data are given for several rotor test modules in the Ames 40 by 80 ft wind tunnel. A model for ground resonance calculations is also described.

76N21162*# ISSUE 12 PAGE 1480 CATEGORY 2 RPT#: NASA-TN-D-8192 A-6375 76/04/00 77 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Stability of elastic bending and torsion of uniform cantilever rotor blades in hover with variable structural coupling

AUTH: A/HODGES, D. H.; ROBERTA.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $5.00
Washington Prepared jointly with Army Air Mobility Res. and Dev. Lab.

MAJS: /*AERODYNAMIC STABILITY/*CANTILEVER MEMBERS/*DYNAMIC STRUCTURAL ANALYSIS/*ELASTIC BENDING/*HOVERING/*RIGID ROTORS/*ROTARY WINGS/*TORSION

MINS: / AERODYNAMIC CONFIGURATIONS/ AEROELASTICITY/ EQUATIONS OF MOTION/ HELICOPTER PERFORMANCE/ NONLINEAR EQUATIONS

ABA: Author

ABS: The stability of elastic flap bending, lead-lag bending, and torsion of uniform, untwisted, cantilever rotor blades without chordwise offsets between the elastic, mass, tension, and aerodynamic center axes is investigated for the hovering flight condition. The equations of motion are obtained by simplifying the general, nonlinear, partial differential equations of motion of an elastic rotating cantilever blade. The equations are adapted for a linearized stability analysis in the hovering flight condition by prescribing aerodynamic forces, applying Galerkin's method, and linearizing the resulting ordinary differential equations about the equilibrium operating condition. The aerodynamic forces are obtained from strip theory based on a quasi-steady approximation of two-dimensional unsteady airfoil theory. Six coupled mode shapes, calculated from free vibration about the equilibrium operating condition, are used in the linearized stability analysis. The study emphasizes the effects of two types of structural coupling that strongly influence the stability of hingeless rotor blades. The first structural coupling is the linear coupling between flap and lead-lag bending of the rotor blade. The second structural coupling is a nonlinear coupling between flap bending, lead-lag bending, and torsion deflections. Results are obtained for a wide variety of hingeless rotor configurations and operating conditions in order to provide a reasonably complete picture of hingeless rotor blade stability characteristics.

76A41966*# ISSUE 21 PAGE 3231 CATEGORY 1
76/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Civil uses of remotely piloted aircraft

AUTH: A/NELMS, W. P., JR.; B/ADERHOLD, J. R. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.); B/(Lockheed Missiles and Space Co., Inc., Sunnyvale, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
In: National Association for Remotely Piloted Vehicles, Annual Symposium, 3rd, Dayton, Ohio, May 3-5, 1976. Proceedings. (A76-41967 21-05) Dayton, Ohio, National Association for Remotely Piloted Vehicles, 1976, 9 p.

MAJS: /*CIVIL AVIATION/*MARKET RESEARCH/*REMOTELY PILOTED VEHICLES/*TECHNOLOGY UTILIZATION

MINS: / AIRCRAFT DESIGN/ REMOTE SENSORS/ ROTARY WING AIRCRAFT/ SURFACE VEHICLES/ USER REQUIREMENTS/ UTILITY AIRCRAFT

ABA: (Author)

ABS: An overview of an ongoing study of civil applications of Remotely Piloted Vehicles (RPVs) is presented, including a summation of results to date and the status of work yet to be completed. The intent of the study is to examine the total technical, economic, and environmental impact of RPVs in the civil environment in order to identify and assess the technological effort required to bring these vehicles to realization. The paper describes a market survey in which some 35 civil applications of RPVs have been

defined and categorized into groups which have similar mission requirements. From this broad analysis of many potential uses, a smaller number of promising and representative applications have been selected for more in-depth analysis. Using one or two of these applications as specific examples, the paper briefly describes system performance requirements and vehicle concepts, and compares the benefits and costs with those of present methods. The paper also reports on the status of other work such as subsystem concepts, assessment of the technology, and the influence of safety and environmental considerations on these future civil RPV systems.

76N18087*# ISSUE 9 PAGE 1075 CATEGORY 3 RPT#:
NASA-TM-X-73098 A-6360 75/12/00 69 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Benefits of VTOL aircraft in offshore petroleum logistics support
AUTH: A/WILCOX, D. E.; B/SHOVLIN, M. D.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC $4.50
MAJS: /*LOGISTICS MANAGEMENT/*OFFSHORE ENERGY SOURCES/* VERTICAL TAKEOFF AIRCRAFT
MINS: / AIR TRANSPORTATION/ ECONOMIC ANALYSIS/ HELICOPTER DESIGN/ PROPULSIVE EFFICIENCY
ABA: Author
ABS: The mission suitability and potential economic benefits of advanced VTOL aircraft were investigated for logistics support of petroleum operations in the North Sea and the Gulf of Mexico. Concepts such as the tilt rotor and lift/cruise fan are promising for future operations beyond 150 miles offshore, where their high cruise efficiency provides savings in trip time, fuel consumption, and capital investment. Depending upon mission requirements, the aircraft operating costs are reduced by as much as 20 percent to 50 percent from those of current helicopters.

76N17157*# ISSUE 8 PAGE 948 CATEGORY 9 RPT#:
NASA-TM-X-73081 A-6371 75/11/00 38 PAGES
UNCLASSIFIED DOCUMENT

UTTL: A discussion of dynamic stability measurement techniques
AUTH: A/JOHNSON, W.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $4.00
Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
MAJS: /*DYNAMIC STABILITY/*SYSTEMS STABILITY/*VIBRATION MEASUREMENT
MINS: / FLUTTER/ MEASURING INSTRUMENTS/ RANDOM VIBRATION/ ROTARY STABILITY/ SPECTRUM ANALYSIS/ TRANSFER FUNCTIONS/ TRANSIENT OSCILLATIONS
ABA: Author
ABS: Techniques for the measurement of the dynamic stability of linear systems are discussed. Particular attention is given to an analysis of the errors in the procedures, and to methods for calculating the system damping from the data. The techniques discussed include: transient decay, moving block analysis, spectral analysis, random decrement signatures, transfer function analysis, and parameter identification methods. The special problems of rotorcraft dynamic stability testing are discussed.

76N10995*# ISSUE 2 PAGE 151 CATEGORY 1 RPT#:
NASA-TM-X-62494 A-6307 75/08/00 27 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Optimal control alleviation of tilting proprotor gust response
AUTH: A/JOHNSON, W.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $4.00
Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
MAJS: /*GUST ALLEVIATORS/*OPTIMAL CONTROL/*TILTING ROTORS
MINS: / AERODYNAMIC LOADS/ DYNAMIC RESPONSE/ HELICOPTER DESIGN/ ROTOR AERODYNAMICS
ABA: Author
ABS: Optimal control theory is applied to the design of a control system for alleviation of the gust response of tilting proprotor aircraft. Using a proprotor and cantilever wing analytical model, the uncontrolled and controlled gust response is examined over the entire operating range of the aircraft except for hover: helicopter mode, conversion, and airplane mode flight. Substantial improvements in the loads, ride quality, and aeroelastic stability are possible with a properly designed controller. A single controller, nominally optimal only at the design point speed (160 knots here), operated efficiently over the entire speed range, with the possible exception of very low speed in helicopter mode. Kalman-Bucy filters were used as compensation networks to provide state estimates from various measurements in the wing motion, rotor speed perturbation, and tip-path-plane tilt.

75N22276*# ISSUE 14 PAGE 1598 CATEGORY 2 RPT#: NASA-TM-X-62425 A-6025 75/04/00 27 PAGES
UNCLASSIFIED DOCUMENT

UTTL: An approximate closed-form solution for lead lag damping of rotor blades in hover

AUTH: A/PETERS, D. A.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $3.75
Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*DAMPING/*HOVERING STABILITY/*ROTARY WINGS

MINS: / AERODYNAMIC FORCES/ CORIOLIS EFFECT/ CRITICAL LOADING/ EQUATIONS OF MOTION/ HELICOPTER CONTROL/ PITCH (INCLINATION)/ STIFFNESS/ TIME LAG

ABA: Author

ABS: Simple stability methods are used to derive an approximate, closed-form expression for the lead-lag damping of rotor blades in hover. Destabilizing terms are shown to be a result of two dynamic mechanisms. First, the destabilizing aerodynamic forces that can occur when blade lift is higher than a critical value are maximized when the blade motion is in a straight line equidistant from the blade chord and the average direction of the air flow velocity. This condition occurs when the Coriolis terms vanish and when the elastic coupling terms align the blade motion with this least stable direction. Second, the nonconservative stiffness terms that result from pitch-flap or pitch-lag coupling can add or subtract energy from the system depending upon whether the motion of the blade tip is clockwise or counterclockwise.

75N25623*# ISSUE 16 PAGE 2025 CATEGORY 61 RPT#: NASA-TM-X-62386 A-5752 75/05/00 200 PAGES
UNCLASSIFIED DOCUMENT

UTTL: User's manual for a parameter identification technique --- with options for model simulation for fixed input forcing functions and identification from wind tunnel and flight measurements

AUTH: A/KANNING, G.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC $7.00

MAJS: /*AERODYNAMIC CHARACTERISTICS/*FLIGHT SIMULATION/*USER MANUALS (COMPUTER PROGRAMS)/*WIND TUNNEL TESTS

MINS: / COMPUTER PROGRAMS/ DIGITAL SYSTEMS/ FORTRAN/ HELICOPTER PERFORMANCE/ IDENTIFYING/ INDEPENDENT VARIABLES/ INPUT/OUTPUT ROUTINES/ MATHEMATICAL MODELS/ SENSITIVITY

ABA: Author

ABS: A digital computer program written in FORTRAN is presented that implements the system identification theory for determininistic systems using input-output measurements. The user supplies programs simulating the mathematical model of the physical plant whose parameters are to be identified. The user may choose any one of three options. The first option allows for a complete model simulation for fixed input forcing functions. The second option identifies up to 36 parameters of the model from wind tunnel or flight measurements. The third option performs a sensitivity analysis for up to 36 parameters. The use of each option is illustrated with an example using input-output measurements for a helicopter rotor tested in a wind tunnel.

75N18183*# ISSUE 10 PAGE 1063 CATEGORY 2 RPT#: NASA-TN-D-7856 A-5494 75/02/00 140 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Flapping response characteristics of hingeless rotor blades by a gereralized harmonic balance method

AUTH: A/PETERS, D. A.; B/ORMISTON, R. A.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $5.75
Washington Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*FLAPPING/*HELICOPTER CONTROL/*RIGID ROTORS/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / AERODYNAMIC CONFIGURATIONS/ AERODYNAMIC FORCES/ NUMERICAL ANALYSIS

ABA: Author

ABS: Linearized equations of motion for the flapping response of flexible rotor blades in forward flight are derived in terms of generalized coordinates. The equations are solved using a matrix form of the method of linear harmonic balance, yielding response derivatives for each harmonic of the blade deformations and of the hub forces and moments. Numerical results and approximate closed-form expressions for rotor derivatives are used to illustrate the relationships between rotor parameters, modeling assumptions, and rotor response characteristics. Finally, basic hingeless rotor response derivatives are presented in tabular and graphical form for a wide range of configuration parameters and operating conditions.

75N24720*# ISSUE 16 PAGE 1914 CATEGORY 5 RPT#: NASA-TM-X-62407 A-5870 75/01/00 105 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/Army XV-15 tilt rotor research aircraft familiarization document

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $5.25
Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*AIRCRAFT DESIGN/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*V/STOL AIRCRAFT

MINS: / AERODYNAMIC CHARACTERISTICS/ FLIGHT SIMULATION/ STRUCTURAL DESIGN/ WIND TUNNEL MODELS

ABA: Author

ABS: The design features and general characteristics of the NASA/Army XV-15 tilt rotor research aircraft are described. This aircraft was conceived as a proof-of-concept vehicle and a V/STOL research tool for integrated wind tunnel, flight-simulation, and flight-test investigations. Discussions of special design provisions and safety considerations necessary to perform these missions are included in this report. In addition to predictions of aircraft and engine performance for the hover, helicopter, and airplane flight modes, analytical estimates of the structural and dynamic limitations of the XV-15 are provided.

76A14585* ISSUE 4 PAGE 446 CATEGORY 5 75/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: An analytical study of a multicycle controllable twist rotor --- of helicopters

AUTH: A/MCCLOUD, J. L., III PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
In: American Helicopter Society, Annual National Forum, 31st, Washington, D.C., May 13-15, 1975. Proceedings. (A76-14565 04-05) New York, American Helicopter Society, Inc., 1975. 11 p.

MAJS: /*FLAPS (CONTROL SURFACES)/*HELICOPTER PERFORMANCE/*ROTARY WINGS/*SERVOCONTROL/*TORSIONAL VIBRATION

MINS: / DEFLECTION/ HARMONIC OSCILLATION/ MATRIX THEORY/ VIBRATION TESTS

ABA: (Author)

ABS: A rotor employing a servo-flap to effect blade torsional deflections (the Kaman Controllable Twist Rotor) has been used in a theoretical study to assess the potential of multicyclic flap control. (i.e., 1P, 2P, 3P, and 4P flap deflections). The results show that virtual elimination of pylon vibratory loads may be achieved with concurrent blade bending moments reduced by 50%. The amplitude requirements of the higher harmonic deflections are of the order of 3 or 4 deg. The study is in two parts: the calculation of rotor loads for specific combinations of multicyclic flap deflections by a typical rotor computer analysis, and an analysis of those results to determine optimum combinations of the multicyclic flap control. The paper discusses the analysis and indicates the potentials of a multicyclic controllable twist rotor.

76A14566* ISSUE 4 PAGE 435 CATEGORY 2 75/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Laser velocimeter measurements of rotor blade loads and tip vortex rollup

AUTH: A/BIGGERS, J. C.; B/CHU, S.; C/ORLOFF, K. L. PAA: C/(NASA, Ames Research Center, Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
In: American Helicopter Society, Annual National Forum, 31st, Washington, D.C., May 13-15, 1975. Proceedings. (A76-14565 04-05) New York, American Helicopter Society, Inc., 1975. 7 p.

MAJS: /*AERODYNAMIC LOADS/*BLADE TIPS/*HELICOPTER PERFORMANCE/*LASER DOPPLER VELOCIMETERS/*ROTARY WINGS/*VORTICES

MINS: / DATA PROCESSING/ FLOW DISTRIBUTION/ FLOW MEASUREMENT / LIFT

ABA: (Author)

ABS: A method for obtaining and analyzing the instantaneous velocities of helicopter rotor flow fields through use of a laser velocimeter capable of simultaneously sensing two components of velocity is described. Rotor blade aerodynamic loads may be computed from the velocity distributions near the blades. The experiment was conducted with a 2.13 m (7 ft) diameter model helicopter rotor operating in a wind tunnel. Velocity distributions are presented which document the flow field near the advancing blade. Circulation is calculated from the velocity measurements, and the radial distribution of circulation is discussed. The influence of the tip vortex from the preceding blade is apparent in this distribution. Tip vortex rollup on the advancing blade was documented by making a series of measurements at various distances behind the blade. Effects of blade drag are evident in the velocities behind the blade trailing edge.

76N73529* CATEGORY 98 RPT#: NASA-TM-X-73034
75/00/00 51 PAGES UNCLASSIFIED DOCUMENT

UTTL: Summary of minutes, NASA Research and Technology Advisory Council, Committee on Aerodynamics and Configurations

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
Conf. held at Moffett Field, Calif., 17-19 Sep. 1975

MAJS: /*AERODYNAMIC CONFIGURATIONS/*AERODYNAMICS/*LIFT FANS/*NOISE REDUCTION/*QUIET ENGINE PROGRAM/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM

MINS: / AEROELASTICITY/ CANARD CONFIGURATIONS/ COMBUSTION EFFICIENCY/ FUEL CONSUMPTION/ NASA PROGRAMS/ RIGID ROTORS/ ROCKET EXHAUST/ ROTOR AERODYNAMICS/ VORTICES/ WIND TUNNELS

75N12906*# ISSUE 4 PAGE 377 CATEGORY 2 RPT#: NASA-TN-D-7834 A-5289 74/12/00 68 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of a parameter identification technique to a hingeless helicopter rotor

AUTH: A/KANNING, G.; B/BIGGERS, J. C.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP: HC $4.25
Washington

MAJS: /*FLUTTER ANALYSIS/*HELICOPTERS/*RIGID ROTORS/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / AERODYNAMIC CHARACTERISTICS/ DATA ACQUISITION/ EQUATIONS OF MOTION/ MATHEMATICAL MODELS

ABA: Author

ABS: A mathematical model of a gyro-controlled, three bladed hingeless helicopter rotor was developed and parameters of the model were estimated using a parameter identification technique. The flapping and feathering degrees of freedom of the blades were modeled. The equations of the model contain time-varying, periodic coefficients due to the forward speed of the rotor. A digital simulation of the analytical model was compared with wind-tunnel measurements to establish the validity of the model. Comparisons of steady-state and transient solutions of the analytical model with the tunnel measurements gave reasonably good matching of gyro angle but less satisfactory matching of hub moment measurements. Further improvements were obtained by use of a parameter identification technique to adjust as many as 10 parameters of the analytical model. The sensitivity of the blade response to small changes in the parameters was also calculated.

75N10058*# ISSUE 1 PAGE 8 CATEGORY 5 RPT#: NASA-TM-X-62390 74/10/00 58 PAGES UNCLASSIFIED DOCUMENT

UTTL: Techniques for improving the stability of soft inplane hingeless rotors

AUTH: A/ORMISTON, R. A.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $4.25
Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*AERODYNAMIC STABILITY/*RIGID ROTORS/*ROTOR BLADES/*VIBRATION DAMPING

MINS: / AERODYNAMIC CONFIGURATIONS/ ELASTIC DAMPING/ HELICOPTER PROPELLER DRIVE/ HOVERING/ LOW THRUST

ABA: Author

ABS: The influence of basic parameters that govern flap lag stability of hingeless rotor blades in hover is reviewed, and potential methods are studied for improving the lead lag damping of soft inplane configurations for low thrust conditions. These conditions are relevant for ground and air resonance stability of coupled rotor body dynamic systems. Results indicate that the isolated rotor blade lead lag damping can be usefully increased by a combination of flap lag elastic coupling and pitch lag coupling. For a typical soft inplane configuration, 6% of critical damping can be obtained for moderate pitch lag coupling. For large values of the coupling parameters, the lead lag frequency is substantially reduced at high pitch angles and airfoil stall effects also reduce the lead lag damping.

74N15973*# ISSUE 7 PAGE 777 CATEGORY 12 RPT#: NASA-TM-X-62330 74/01/00 104 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind tunnel investigation of aerodynamic characteristics of a scale model of a D5 bulldozer and an M109 self-propelled 155 mm Howitzer

AUTH: A/LAUB, G. H.; B/KODANI, H. M.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $7.25
Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*CRAWLER TRACTORS/*HOWITZERS/*WIND TUNNEL STABILITY TESTS

MINS: / AERODYNAMIC CHARACTERISTICS/ HELICOPTERS/ SCALE MODELS/ SUSPENDING (HANGING)

ABA: Author

ABS: Wind tunnel tests were conducted on a scale model of a

D5 bulldozer and an M109 self-propelled 155 MM howitzer to determine the aerodynamic characteristics of these typical externally-suspended heavy lift helicopter cargo configurations. Tests were made over a large range of pitch and yaw attitudes at a nominal Reynolds number per unit length of 1.5 x 10 to the 6th power.

76A10454*# ISSUE 1 PAGE 57 CATEGORY 35
74/00/00 26 PAGES UNCLASSIFIED DOCUMENT
UTTL: Laser velocimeter measurement of developing and periodic flows
AUTH: A/ORLOFF, K. L.; B/BIGGERS, J. C. PAA: B/(NASA, Ames Research Center, Moffett Field, Calif.)
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
In: International Workshop on Laser Velocimetry, 2nd, West Lafayette, Ind., March 27-29, 1974, Proceedings. Volume 2. (A76-10426 01-35) West Lafayette, Ind., Purdue University, 1974, p. 143-165; Discussion, p. 166-168.
MAJS: /*FLUID DYNAMICS/*LASER APPLICATIONS/*LENS DESIGN/*VELOCITY MEASUREMENT/*VORTICES/*WIND TUNNEL TESTS
MINS: / FLOW DISTRIBUTION/ HELICOPTER PROPELLER DRIVE/ OPTICAL EQUIPMENT/ OSCILLATING FLOW/ PERIODIC VARIATIONS/ SPECTRUM ANALYSIS/ TRAILING EDGES/ TRANSMITTER RECEIVERS/ WATER FLOW/ WIND TUNNELS
ABA: (Author)
ABS: The transmitting-receiving lens system of a two-component backscatter laser-velocimeter optical package currently in operation is discussed. It is basically a Galilean-type telescope which provides for spatial translation of the focal volume along the optical axis, but it also has certain optical constraints which are discussed. This scanning feature of the unit has been used with spectrum analyzer processing for the measurement of (1) trailing vortices in a wind tunnel and (2) a developing (decaying) vortex that was generated by towing a wing model through a water towing tank. The optical system has also been interfaced with period counting electronics and has been applied to the periodic flow generated by a model helicopter rotor. Results are presented and the techniques of data acquisition and the 'strobing' of the processor are discussed.

74N34494* ISSUE 24 PAGE 2902 CATEGORY 2
74/00/00 9 PAGES UNCLASSIFIED DOCUMENT
UTTL: Some approximations to the flapping stability of helicopter rotors
AUTH: A/BIGGERS, J. C.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
In Its Rotorcraft Dyn. p 45-53 (SEE N74-34489 24-02)
MAJS: /*AIRCRAFT STABILITY/*FLAPPING/*ROTARY WINGS
MINS: / HELICOPTER CONTROL/ MATHEMATICAL MODELS/ ROTOR AERODYNAMICS
ABA: Author
ABS: The flapping equation for a helicopter in forward flight are reported which have coefficients that are periodic in time, and this effect complicates the calculation of stability. A constant coefficient approximation which will allow the use of all the well known methods for analyzing constant coefficient equations are presented. The flapping equation is first transformed into the nonrotating coordinate frame, where some of the periodic coefficients are transformed into constant terms. The constant coefficient approximation is then made by using time averaged coefficients in the nonrotating frame. Stability calculations based on the approximation are compared to results from a theory which correctly includes all of the periodicity. The comparison indicates that the approximation is reasonably accurate at advance ratios up to 0.5.

74N34489*# ISSUE 24 PAGE 2901 CATEGORY 2 RPT#: NASA-SP-352 74/00/00 370 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotorcraft Dynamics
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC $8.60
Washington Conf. held at Moffett Field Calif., 13-15 Feb. 1974; Sponsored in part by the American Helicopter Soc.
MAJS: /*CONFERENCES/*ROTOR AERODYNAMICS/*ROTORCRAFT AIRCRAFT
MINS: / DYNAMIC STRUCTURAL ANALYSIS/ HELICOPTERS/ LOADS (FORCES)/ ROTARY WINGS/ VIBRATION
ANN: The dynamic structural analysis of rotary winged aircraft is reported, considering helicopter vibration and loads

73N24897*# ISSUE 15 PAGE 1838 CATEGORY 32
RPT#: NASA-TM-X-2770 A-4629 73/05/00 36 PAGES UNCLASSIFIED DOCUMENT
UTTL: Nonlinear equations for bending of rotating beams with application to linear flap-lag stability of hingeless rotors
UNOC: Numerical analysis of bending of rotating beams with application to linear flap-lag stability of hingeless rotary wings using nonlinear equations
AUTH: A/HODGES, D. H.; B/ORMISTON, R. A.
CORP: National Aeronautics and Space Administration. Ames

Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $3.00
Washington Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*BENDING MOMENTS/*HELICOPTERS/*RIGID ROTORS/*ROTARY WINGS/*STRUCTURAL ANALYSIS

MINS: / CANTILEVER BEAMS/ ELASTIC BENDING/ NUMERICAL ANALYSIS

ABA: Author

ABS: The nonlinear partial differential equations for the flapping and lead-lag degrees of freedom of a torisonally rigid, rotating cantilevered beam are derived. These equations are linearized about an equilibrium condition to study the flap-lag stability characteristics of hingeless helicopter rotor blades with zero twist and uniform mass and stiffness in the hovering flight condition. The results indicate that these configurations are stable because the effect of elastic coupling more than compensates for the destabilizing flap-lag Coriolis and aerodynamic coupling. The effect of higher bending modes on the lead-lag damping was found to be small and the common, centrally hinged, spring restrained, rigid blade approximation for elastic rotor blades was shown to be resonably satisfactory for determining flap-lag stability. The effect of pre-cone was generally stabilizing and the effects of rotary inertia were negligible.

72N33027*# ISSUE 24 PAGE 3168 CATEGORY 2 RPT#: NASA-TM-X-62195 72/10/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter payload gains utilizing water injection for hot day power augmentation

UNOC: Helicopter payload gains utilizing water injection for hot day power augmentation

AUTH: A/STROUB, R. H.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $3.00
Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*CH-47 HELICOPTER/*PAYLOADS/*POWER GAIN/*UH-1 HELICOPTER/*WATER INJECTION

MINS: / AIRCRAFT PERFORMANCE/ ATMOSPHERIC TEMPERATURE/ HOVERING

ABA: Author

ABS: An analytical investigation was undertaken to assess the gains in helicopter mission payload through the use of water injection to produce power augmentation in an altitude-hot day environment. Substantial gains are shown for two representative helicopters, the UH-1H and CH-47B. The UH-1H payload increased 86.7 percent for a 50 n.mi. (92.6 km) radius mission involving two out-of-ground effect (OGE) hover take-offs of 2 minutes each at 5000 ft. (1525 m) 35 C ambient conditions. The CH-47B payload increased 49.5 percent for a 50 n.mi. (92.6 km) radius mission with sling loaded cargo as the outbound payload and a 3000 lb. (1360 kg) internal cargo on the return leg. The mission included two 4 min. OGE hovers at 6000 ft. (1830 m) 35 C. An improvement in take off performance and maximum performance climb also resulted as a consequence of the OGE hover capability and higher maximum power available.

73N14006*# ISSUE 5 PAGE 492 CATEGORY 1 RPT#: NASA-TM-X-62165 72/07/00 123 PAGES UNCLASSIFIED DOCUMENT

UTTL: A pertinent solution of helicopter rotor flapping stability

UNOC: Application of perturbation techniques to single blade helicopter rotor dynamics

AUTH: A/JOHNSON, W. PAA: A/(Army Air Mobility R&D Lab., Moffett Field, Calif.)

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC $6.25

MAJS: /*HELICOPTERS/*PERTURBATION THEORY/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / AERODYNAMIC STABILITY/ EQUATIONS OF MOTION/ PROBLEM SOLVING

ABA: Author

ABS: The stability of the flapping motion of a single blade of a helicopter rotor is examined using the techniques of perturbation theory. The equation of motion studied is linear, with periodic aerodynamic coefficients due to the forward speed of the rotor. Solutions are found for four cases: small and large advance ratio and small and large Lock number. The perturbation techniques appropriate to each case are discussed and illustrated in the course of the analysis. The application of perturbation techniques to other problems in rotor dynamics is discussed. It is concluded that perturbation theory is a powerful mathematical technique which should prove very useful in analyzing some of the problems of helicopter dynamics.

72N27995*# ISSUE 19, PAGE 2503 CATEGORY 1 RPT#: NASA-TM-X-62169 72/07/00 93 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind tunnel investigation of aerodynamic characteristics of scale models of three rectangular shaped cargo containers

UNOC: Wind tunnel tests to determine aerodynamic characteristics of rectangular shaped containers carried as external stores on helicopters

AUTH: A/LAUB, G. H.; B/KODANI, H. M.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC $6.75
Sponsored in part by AAMRDL

MAJS: /*AERODYNAMIC CHARACTERISTICS/*EXTERNAL STORES/* HELICOPTERS/*WIND TUNNEL MODELS

MINS: / AERODYNAMIC CONFIGURATIONS/ CONTAINERS/ DATA ACQUISITION

ABA: Author

ABS: Wind tunnel tests w . conducted on scale models of three rectangular shaped cargo containers to determine the aerodynamic characteristics of these typical externally-suspended helicopter cargo configurations. Tests were made over a large range of pitch and yaw attitudes at a nominal Reynolds number per unit length of 1.8 x one million. The aerodynamic data obtained from the tests are presented.

72N26010*# ISSUE 17 PAGE 2235 CATEGORY 2 RPT#: NASA-TM-X-62152 CNT#: NAS2-4389 72/04/00 111 PAGES UNCLASSIFIED DOCUMENT

UTTL: Feasibility study of a bidirectional jet flap device for application to helicopter rotor blades. Phase 2: Lift controller development

UNOC: Development and evaluation of variable direction thruster for application to helicopter rotors based on bidirectional jet flap device

AUTH: A/ROSE, R. E.; B/WYNN, T. M.; C/SMITH, G. A.; D/MERRILL, G. L.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.; Honeywell, Inc., St. Paul, Minn.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC $7.75
Prepared by Honeywell, Inc., St. Paul, Minn. and Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.

MAJS: /*HELICOPTERS/*JET FLAPS/*ROTARY WINGS/*THRUST VECTOR CONTROL

MINS: / AERODYNAMIC BALANCE/ AERODYNAMIC STABILITY/ HELICOPTER CONTROL

ABA: Author

ABS: A bidirectional jet flap device called the variable deflection thruster (VDT) has been investigated for possible application to helicopter rotors. This investigation included the development and testing of a fluidic lift control system for the VDT-blade model making use of the test result that VDT-blade lift can be sensed from the differential pressure at midchord. This study constitutes a long-range program to develop blown control techniques for stabilizing the higher harmonic modes of helicopter rotors. Wind tunnel tests were conducted using a three-sectioned, two-dimensional VDT-blade model having individually controlled VDT jet flaps in each section. Steady-state tests were conducted without the fluidic lift controller (open loop) for both full-span blowing and for the model center section blowing only. Steady-state tests were conducted with the center section blowing only using the fluidic lift controller (close-loop) to control the lift on the model center section. Dynamic tests were conducted using the complete model with the VDT jet in the model center section oscillating at various frequencies and also using the model center section alone on a single endplate to obtain finite-aspect-ratio effects. Fair agreement was obtained between theory and experimental results.

71N33517*# ISSUE 20 CATEGORY 2 RPT#: NASA-TM-X-62081 CNT#: 721-60-10-02-00-21 71/08/00 54 PAGES UNCLASSIFIED DOCUMENT

UTTL: An investigation of a full-scale advancing blade concept rotor system at high advance ratio

UNOC: Wind tunnel tests of full scale advancing blade concept rotor system at high advance ratio

AUTH: A/FALARSKI, M. D.; B/MC CLOUD, J. L.; C/SODERMAN, P. T.; D/STROUB, R. H.

CORP: Army Air Mobility Research and Development Lab., Moffett Field, Calif.; National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: AVAIL- NTIS
PREPARED JOINTLY WITH ARMY AIR MOBILITY RES. AND DEVELOP. LAB., MOFFETT FIELD, CALIF.

MAJS: /*HELICOPTERS/*LIFT DRAG RATIO/*ROTARY WINGS

MINS: / AERODYNAMIC STALLING/ SYSTEMS ENGINEERING/ WIND TUNNEL STABILITY TESTS

71N23779*# ISSUE 12 PAGE 1851 CATEGORY 1 RPT#: NASA-TN-D-6321 A-3863 CNT#: 721-60-10-02-00-21 71/04/00 38 PAGES UNCLASSIFIED DOCUMENT

UTTL: Measurements of boundary layer transition, separation and streamline direction on rotating blades

UNOC: Laminar boundary layer transition, separation and streamline direction on rotating helicopter blades

AUTH: A/MC CROSKEY, W. J.
CORP: Army Air Mobility Research and Development Lab., Moffett Field, Calif.; National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
WASHINGTON PREPARED IN COOPERATION WITH ARMY AIR MOBILITY RES. AND DEVELOP. LAB., MOFFETT FIELD, CALIF.
MAJS: /*BOUNDARY LAYER TRANSITION/*FLOW VISUALIZATION/* HELICOPTER PROPELLER DRIVE/*ROTOR AERODYNAMICS
MINS: / BOUNDARY LAYER SEPARATION/ LAMINAR BOUNDARY LAYER/ LAMINAR FLOW/ ROTOR BLADES

72N13016*# ISSUE 4 PAGE 433 CATEGORY 2
71/00/00 15 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effects of advanced technology on STOL transport aircraft
UNOC: Advanced technology applications for improving STOL transport aircraft aerodynamics, propulsion, structure, and flight dynamics
AUTH: A/COOK, W. L.
CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS
SAP. HC $6.00/MF $0.95
In its Vehicle Technol. for Civil Aviation p 359-373
(SEE N72-12995 04-02
MAJS: /*CIVIL AVIATION/*SHORT TAKEOFF AIRCRAFT/* TECHNOLOGICAL FORECASTING/*TRANSPORT AIRCRAFT
MINS: / AERODYNAMIC CHARACTERISTICS/ AIRCRAFT STRUCTURES/ CONFERENCES/ HELICOPTER PERFORMANCE/ PROPULSION SYSTEM CONFIGURATIONS
ABA: Author
ABS: The objectives of this study are as follows: (1) application of specific technology advances to commercial STOL transportation; (2) total effect of technology advances on STOL transport aircraft gross weight, direct operating cost, and acceptance; and (3) assessment of advanced technology progress for STOL transportation in the 1980's.

PRINT 45/2/1-158 TERMINAL=20

82N19707*# ISSUE 10 PAGE 1394 CATEGORY 45
RPT#: NASA-TP-1969 L-14936 82/02/00 59 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Effects of repetition rate and impulsiveness of simulated helicopter rotor noise on annoyance

AUTH: A/POWELL, C. A.; B/MCCURDY, D. A.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE TOLERANCE/* PRESSURE PULSES/*PULSE RATE/*ROTARY WINGS

MINS: / ACOUSTIC SIMULATION/ IMPULSES/ NOISE MEASUREMENT/ REGRESSION ANALYSIS

ABA: Author

ABS: Annoyance judgements were obtained for computer generated stimuli simulative of helicopter impulsive rotor noise to investigate effects of repetition rate and impulsiveness. Each of the 82 different stimuli was judged at 3 sound pressure levels by 48 subjects. Impulse repetition rates covered a range from 10 Hz to 115 Hz; crest factors covered a range from 3.2 dB to 19.3 dB. Increases in annoyance with increases in repetition rate were found which were not predicted by common loudness or annoyance metrics and which were independent of noise level. The ability to predict effects of impulsiveness varied between the noise metrics and was found to be dependent on noise level. The ability to predict the effects of impulsiveness was not generally improved by any of several proposed impulsiveness corrections. Instead, the effects of impulsiveness were found to be systematically related to the frequency content of the stimuli. A modified frequency weighting was developed which offers improved annoyance prediction.

82A15847*# ISSUE 4 PAGE 501 CATEGORY 6
81/12/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Experimental evaluation of a perspective tunnel display for three-dimensional helicopter approaches

AUTH: A/GRUNWALD, A. J.; B/ROBERTSON, J. B.; C/HATFIELD, J. J. PAA: A/(Technion - Israel Institute of Technology, Haifa, Israel); C/(NASA, Langley Research Center, Flight Electronics Div., Hampton, VA)

CORP: Technion - Israel Inst. of Tech., Haifa.; National Aeronautics and Space Administration. Langley Research Center, Hampton, Va

Journal of Guidance and Control, Vol. 4, Nov.-Dec. 1981, p. 623-631.

MAJS: /*APPROACH INDICATORS/*COMPUTER GRAPHICS/*DISPLAY DEVICES/*HELICOPTER CONTROL/*THREE DIMENSIONAL MOTION

MINS: / COMPUTERIZED SIMULATION/ DESCENT TRAJECTORIES/ PREDICTION ANALYSIS TECHNIQUES/ SYMBOLS/ TRAJECTORY OPTIMIZATION

ABA: (Author)

ABS: A computer-generated perspective tunnel display for a steep and strongly curved three-dimensional helicopter approach is studied. The necessary control variables for following a curved trajectory are analyzed, the effectiveness of superimposed predictor symbology is investigated, and a suitable predictor law is formulated. The theoretical considerations are validated by an extensive fixed-base simulator program. The tunnel display with a superimposed predictor symbol is shown to outperform conventional-type displays in its abilities to follow a curved trajectory in the presence of gust disturbances, to enter the trajectory from an unknown position outside this trajectory, as well as to monitor automatic approaches. The feasibility of the tunnel display for operation in actual flight has been demonstrated in an exploratory flight test.

82N71456*# CATEGORY 2 RPT#: NASA-TP-1965 L-14825 AVRADCOM-TR-81-B-6 CNT#: PROJ. FEDD DA PROJ. 1L1-61102-AH-45 81/12/00 79 PAGES UNCLASSIFIED DOCUMENT DOMESTIC

UTTL: Two-dimensional aerodynamic characteristics of an airfoil designed for rotorcraft application TLSP: An Early Domestic Dissemination Report

AUTH: A/BINGHAM, G. J.; B/NOONAN, K. W.; C/SEWALL, W. G.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. SAP: Avail: NASA Industrial Applications Centers only to U.S. requesters: HC A05/MF A01

MAJS: /*AERODYNAMIC CHARACTERISTICS/*AIRFOIL PROFILES/*ROTOR AERODYNAMICS/*TWO DIMENSIONAL FLOW/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC COEFFICIENTS/ CHARTS/ COORDINATES/ HELICOPTER WAKES/ TRANSONIC WIND TUNNELS

82N17871*# ISSUE 8 PAGE 1131 CATEGORY 53 RPT#: NASA-TM-83251 81/12/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: An evaluation of helicopter noise and vibration ride qualities criteria

AUTH: A/HAMMOND, C. E.; B/HOLLENBAUGH, D. D.; C/CLEVENSON, S. A.; D/LEATHERWOOD, J. D.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Research and Technology Labs., Fort Eustis, Va. AVAIL.NTIS SAP: HC A02/MF A01

Prepared in cooperation with Army Research and Technology Lab., Fort Eustis, Va. Presented at the Technol. for the Jet Smooth Ride, A Natl. Specialists' Meeting on Helicopter Vibration, Hartford, Conn., 2-4

Nov. 1981: sponsored by the American Helicopter Society

MAJS: /*AIRCRAFT NOISE/*COMFORT/*CRITERIA/*HELICOPTERS/* RIDING QUALITY/*VIBRATION

MINS: / HUMAN FACTORS ENGINEERING/ NOISE INTENSITY/ NOISE MEASUREMENT/ VIBRATION MEASUREMENT

ABA: T.M.

ABS: Two methods of quantifying helicopter ride quality; absorbed power for vibration only and the NASA ride comfort model for both noise and vibration are discussed. Noise and vibration measurements were obtained on five operational US Army helicopters. The data were converted to both absorbed power and DISC's (discomfort units used in the NASA model) for specific helicopter flight conditions. Both models indicate considerable variation in ride quality between the five helicopters and between flight conditions within each helicopter.

82N14058*# ISSUE 5 PAGE 576 CATEGORY 2 RPT#: NASA-TM-83226 81/11/00 181 PAGES UNCLASSIFIED DOCUMENT

UTTL: A flight investigation of blade-section aerodynamics for a helicopter main rotor having 10-64C airfoil sections

AUTH: A/MORRIS, C. E. K., JR.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A09/MF A01

MAJS: /*AIRFOIL PROFILES/*FLIGHT TESTS/*HELICOPTER PERFORMANCE/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / HOVERING/ HUBS/ PRESSURE DISTRIBUTION/ TABLES (DATA) / TEETERING/ WIND TUNNEL TESTS

ABA: A.R.H.

ABS: Pressure data at 90 percent blade radius were obtained for a helicopter main rotor with 10-64C blade sections during flight. Concurrent measurements ere made of vehicle flight state, performance and some rotor loads. The test envelope included hover, level flight from about 65 to 162 knots, climb and descent, and collective fixed maneuvers. Good agreement is shown between some sets of airfoil pressure distributions obtained in flight and those from two-dimensional wind-tunnel tests or theoretical calculations.

81N29119*# ISSUE 20 PAGE 2725 CATEGORY 5 RPT#: NASA-TM-81951 L-14392 81/08/00 71 PAGES UNCLASSIFIED DOCUMENT

UTTL: US and USSR Military Aircraft and Missile Aerodynamics 1970-1980. A selected, annotated bibliography, volume 1

AUTH: A/TUTTLE, M. H.; B/MADDALON, D. V.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*AERODYNAMICS/*AIRCRAFT DESIGN/*AIRCRAFT PERFORMANCE /*BIBLIOGRAPHIES/*MISSILES/*U.S.S.R./*UNITED STATES OF AMERICA

MINS: / ATTACK/ BOMBER AIRCRAFT/ FIGHTER AIRCRAFT/ HELICOPTERS/ VERTICAL TAKEOFF AIRCRAFT

ABA: Author

ABS: The purpose of this selected bibliography (281 citations) is to list available, unclassified, unlimited publications which provide aerodynamic data on major aircraft and missiles currently used by the military forces of the United States of America and the Union of Soviet Socialist Republics. Technical disciplines surveyed include aerodynamic performance, static and dynamic stability, stall/spin, flutter, buffet, inlets nozzles, flap performance, and flying qualities. Concentration is on specific aircraft including fighters, bombers, helicopters, missiles, and some work on transports, which are or could be used for military purposes. The bibliography is limited to material published from 1970 to 1980. The publications herein illustrate many of the types of aerodynamic data obtained in the course of aircraft development programs and may therefore provide some guidance in identifying problems to be expected in the conduct of such work. As such, this information may be useful in planning future research programs.

81N76797* CATEGORY 2 RPT#: NASA-TP-1864 AVRADCOM-TR-81-B-3 L-14182 CNT#: PROJ. FEDD DA PROJ. 1L1-61102-AH-45 81/07/00 78 PAGES UNCLASSIFIED DOCUMENT DOMESTIC

UTTL: Experimental investigation of a 10-percent-thick helicopter rotor airfoil section designed with a viscous transonic analysis code

AUTH: A/NOONAN, K. W.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. CSS: (Structures Lab. Is An Early Domestic Dissemination Report) SAP: Avail: NASA Industrial Applications Centers only to U.S. requesters: HC A05/MF A01

MAJS: /*AIRFOIL PROFILES/*HELICOPTER DESIGN/*ROTARY WINGS/* TRANSONIC SPEED/*VISCOUS FLOW

MINS: / AERODYNAMIC COEFFICIENTS/ AERODYAMIC DRAG/ FORCE DISTRIBUTION/ HELICOPTER WAKES/ PITCHING MOMENTS/ SCALE MODELS/ STATIC PRESSURE/ WIND TUNNEL TESTS

81A33952*# ISSUE 14, PAGE 2299 CATEGORY 5 RPT#: AHS PAPER 81-58 81/05/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Acoustic performance evaluation of an advanced UH-1 helicopter main rotor system

AUTH: A/HOAD, D. R.; B/CONNER, D. A. PAA: B/(NASA, Langley Research Center, Structures Laboratory, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
American Helicopter Society, Annual Forum, 37th, New Orleans, La., May 17-19, 1981, 10 p.

MAJS: /*AIRCRAFT NOISE/*HELICOPTER PERFORMANCE/*NOISE MEASUREMENT/*PERFORMANCE PREDICTION/*ROTARY WINGS/*UH-1 HELICOPTER

MINS: / NOISE REDUCTION/ WIND TUNNEL TESTS

ABA: (Author)

ABS: An experimental investigation of the high-speed impulsive noise characteristics of an advanced main rotor system for the UH-1 helicopter has been conducted. Models of both the advanced main rotor system and the UH-1 main rotor system were tested at one-quarter scale in the Langley 4- by 7-meter (V/STOL) Tunnel using the General Rotor Model System (GRMS). Tests were conducted over a range of simulated flight and descent velocities. The tunnel was operated in the open-throat configuration with acoustic treatment to improve the acoustic characteristics of the test chamber. In-plane acoustic measurements of the high-speed impulsive noise demonstrated a 7 to 8 dB reduction in noise generation is available by using the advanced rotor system on the UH-1 helicopter.

81N21973*# ISSUE 12 PAGE 1692 CATEGORY 71 RPT#: NASA-TP-1833 L-14205 81/04/00 43 PAGES UNCLASSIFIED DOCUMENT

UTTL: Subjective field study of response to impulsive helicopter noise

AUTH: A/POWELL, C. A.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*AIRCRAFT NOISE/*EFFECTIVE PERCEIVED NOISE LEVELS/*HELICOPTERS/*NOISE PREDICTION (AIRCRAFT)/*PSYCHOACOUSTICS

MINS: / DATA ACQUISITION/ IMPULSES/ REGRESSION ANALYSIS/ ROTARY WINGS/ ROTOR SPEED/ TABLES (DATA)

ABA: A.R.H.

ABS: Subjects, located outdoors and indoors, judged the noisiness and other subjective noise characteristics of flyovers of two helicopters and a propeller driven airplane as part of a study of the effects of impulsiveness on the subjective response to helicopter noise. In the first experiment, the impulsive characteristics of one helicopter was controlled by varying the main rotor speed while maintaining a constant airspeed in level flight. The second experiment which utilized only the helicopters, included descent and level flight operations. The more impulsive helicopter was consistently judged less noisy than the less impulsive helicopter at equal effective perceived noise levels (EPNL). The ability of EPNL to predict noisiness was not improved by the addition of either of two proposed impulse corrections. A subjective measure of impulsiveness, however, which was not significantly related to the proposed impulse corrections, was found to improve the predictive ability of EPNL.

81N21027*# ISSUE 12 PAGE 1575 CATEGORY 2 RPT#: NASA-TM-81956 USAAVRADCOM-TR-81-B-1 81/03/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fluid mechanics mechanisms in the stall process of helicopters

AUTH: A/YOUNG, W. H., JR.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Aviation Research and Development Command, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va. Presented at Symp. on Numerical and Phys. Aspects of Aerodyn. Flows, Long Beach, Calif., 19-21 Jan. 1981

MAJS: /*AERODYNAMIC STALLING/*AIR FLOW/*HELICOPTER WAKES/*HELICOPTERS/*ROTOR AERODYNAMICS/*VORTEX SHEDDING

MINS: / AEROELASTICITY/ DOWNWASH/ FLOW DISTRIBUTION/ PRESSURE

ABA: J.D.H.

ABS: Recent experimental results from airfoils in the Mach number, Reynolds number, or reduced frequency ranges typical of helicopter rotor blades have identified the most influential flow mechanisms in the dynamic stall process. The importance of secondary shed vortices, downstream wake action, and the flow in the separated region is generally acknowledged but poorly understood. By means of surface pressure cross-correlations and flow field measurements in static stall, several new hypotheses have been generated. It is proposed that vortex shedding may be caused by acoustic disturbances propagating forward in the lower (pressure) surface boundary layer, that wake closure is a misnomer, and that the shed vortex leaves a trail of vorticity that forms a turbulent free shear layer. The known dynamic stall flow mechanisms are reviewed and the potential importance of recently proposed and hypothetical flow phenomena with respect

to helicopter blade aeroelastic response are assessed.

81N19087* ISSUE 10 PAGE 1301 CATEGORY 5 RPT#: NASA-CASE-LAR-11797-1 US-PATENT-4,245,956 US-PATENT-APPL-SN-969755 US-PATENT-CLASS-416-114 US-PATENT-CLASS-244-17.25 US-PATENT-CLASS-416-500 US-PATENT-CLASS-74-519 81/01/20 6 PAGES UNCLASSIFIED DOCUMENT
Filed 25 Dec. 1978 Supersedes N79-15057 (17 - 06, p 0694)

UTTL: Compensating linkage for main rotor control TLSP: Patent

AUTH: A/JEFFERY, P. A. E.; B/HUBER, R. F. PAA: A/(United Aircraft Corp., Stratford, Conn.); B/(United Aircraft Corp., Stratford, Conn.) PAT: B/inventors (to NASA)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; United Aircraft Corp., Stratford, Conn. SAP: Avail: US Patent and Trademark Office
Sponsored by NASA

MAJS: /*LINKAGES/*ROTARY WINGS/*TRANSMISSIONS (MACHINE ELEMENTS)

MINS: / MECHANICAL DEVICES/ PATENTS/ ROTARY WING AIRCRAFT

ABA: Official Gazette of the U.S. Patent and Trademark Office

ABS: A compensating linkage for the rotor control system on rotary wing aircraft is described. The main rotor and transmission are isolated from the airframe structure by classic suspension. The compensating linkage prevents unwanted signal inputs to the rotor control system caused by relative motion of the airframe structure and the main rotor and transmission.

81A32779*# ISSUE 14 PAGE 2293 CATEGORY 2 81/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fluid mechanics mechanisms in the stall process of airfoils for helicopters

AUTH: A/YOUNG, W. H., JR. PAA: A/(NASA, Langley Research Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: Symposium on Numerical and Physical Aspects of Aerodynamic Flows, Long Beach, Calif., January 19-21, 1981, Proceedings. (A81-32751 14-34) Long Beach, Calif., California State University, 1981, 10 p.

MAJS: /*AERODYNAMIC STALLING/*AIRFOIL PROFILES/*HELICOPTER PERFORMANCE/*ROTARY WINGS

MINS: / BOUNDARY LAYER SEPARATION/ CAVITATION FLOW/ FLUID MECHANICS/ SHOCK WAVE INTERACTION/ TURBULENT BOUNDARY LAYER

ABA: V.L.

ABS: Phenomena that control the flow during the stall portion of a dynamic stall cycle are analyzed, and their effect on blade motion is outlined. Four mechanisms by which dynamic stall may be initiated are identified: (1) bursting of the separation bubble, (2) flow reversal in the turbulent boundary layer on the airfoil upper surface, (3) shock wave-boundary layer interaction behind the airfoil crest, and (4) acoustic wave propagation below the airfoil. The fluid mechanics that contribute to the identified flow phenomena are summarized, and the usefulness of a model that incorporates the required fluid mechanics mechanisms is discussed.

81N15985*# ISSUE 7 PAGE 849 CATEGORY 2 RPT#: NASA-TM-81920 80/12/00 53 PAGES UNCLASSIFIED DOCUMENT

UTTL: Some wake-related operational limitations of rotorcraft

AUTH: A/HEYSON, H. H.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A04/MF A01
Presented at the Fourth Midwest Helicopter Safety Seminar, Joliet, Ill., 3-5 Feb. 1981; sponsored by the Illinois Dept. of Transportation and the FAA

MAJS: /*AERODYNAMIC STABILITY/*GROUND EFFECT/*HELICOPTER WAKES/*ROTOR AERODYNAMICS

MINS: / AERODYNAMIC STALLING/ CAVITATION FLOW/ VORTEX AVOIDANCE/ YAWING MOMENTS

ABA: T.M.

ABS: Wind tunnel measurements show that the wake of a rotor, except at near hovering speeds, is not like that of a propeller. The wake is more like that of a wing except that, because of the slow speeds, the wake velocities may be much greater. The helicopter can produce a wake hazard to following light aircraft that is disproportionately great compared to an equivalent fixed wing aircraft. This hazard should be recognized by both pilots and airport controllers when operating in congested areas. Ground effect is generally counted as a blessing since it allows overloaded takeoffs; however, it also introduces additional operation problems. These problems include premature blade stall in hover, settling in forward transition, shuddering in approach to touchdown and complicatons with yaw control. Some of these problems were treated analytically in an approximate manner and reasonable experiment agreement was obtained. An awareness of these effects can prepare the user for their appearance and their consequences.

81N15982*# ISSUE 7 PAGE 849 CATEGORY 2 RPT#:
NASA-TM-81898 AVRADCOM-TM-81-B-1 80/12/00 140 PAGES
UNCLASSIFIED DOCUMENT

UTTL: A flight investigation of performance and loads for a helicopter with RC-SC2 main-rotor blade sections

AUTH: A/MORRIS, C. E. K., JR.; B/TOMAINE, R. L.; C/STEVENS, D. D.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Aviation Research and Development Command, Hampton, Va. AVAIL.NTIS SAP: HC A07/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.

MAJS: /*AERODYNAMIC LOADS/*AH-1G HELICOPTER/*FLIGHT CHARACTERISTICS/*HELICOPTER PERFORMANCE/*ROTARY WINGS /*ROTOR AERODYNAMICS

MINS: / FLIGHT TESTS/ HELICOPTER PROPELLER DRIVE/ MANEUVERABILITY

ABA: T.M.

ABS: The test envelope included hover, forward-flight speed sweeps from 33 to 74 m/sec (65 to 144 knots), and collective-fixed maneuvers at about 0.25 tip-speed ratio. The data set for each test point describes vehicle flight states, control positions, rotor loads, power requirements and blade motions. Rotor loads were reviewed primarily in terms of peak-to-peak and harmonic content. Lower frequency components predominated for most loads and generally increased with increased airspeed, but not necessarily with increased maneuver load factor.

81N13918*# ISSUE 5 PAGE 561 CATEGORY 2 RPT#:
NASA-TM-80080 L-12774 AVRADCOM-TR-79-49 80/12/00 95 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind-tunnel test of an articulated helicopter rotor model with several tip shapes

AUTH: A/BERRY, J. D.; B/MINECK, R. E

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Aviation Research and Development Command, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.

MAJS: /*AERODYNAMIC COEFFICIENTS/*AIRFOIL PROFILES/*BLADE TIPS/*LIFTING ROTORS/*TORQUE/*WIND TUNNEL TESTS

MINS: / EDGES/ FORCE DISTRIBUTION/ HELICOPTER TAIL ROTORS/ LIFT/ MECHANICAL MEASUREMENT

ABA: Author

ABS: Six interchangeable tip shapes were tested: a square (baseline) tip, an ogee tip, a subwing tip, a swept tip, a winglet tip, and a short ogee tip. In hover at the lower rotational speeds the swept, ogee, and short ogee tips had about the same torque coefficient, and the subwing and winglet tips had a larger torque coefficient than the baseline square tip blades. The ogee and swept tip blades required less torque coefficient at lower rotational speeds and roughly equivalent torque coefficient at higher rotational speeds compared with the baseline square tip blades in forward flight. The short ogee tip required higher torque coefficient at higher lift coefficients than the baseline square tip blade in the forward flight test condition.

80N33348*# ISSUE 24 PAGE 3226 CATEGORY 2 RPT#:
NASA-TM-81871 AVRADCOM-TM-80-B-2 80/10/00 146 PAGES
UNCLASSIFIED DOCUMENT

UTTL: A flight investigation of performance and loads for a helicopter with 10-64C main rotor blade sections

AUTH: A/MORRIS, C. E. K.; B/TOMAINE, R. L.; C/STEVENS, D. D. PAA: B/(AVRADCOM, St. Louis, Mo.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /*AERODYNAMIC LOADS/*AH-1G HELICOPTER/*FLIGHT STABILITY TESTS/*HELICOPTER PERFORMANCE/*TILTING ROTORS/*TIP SPEED

MINS: / AERODYNAMIC STABILITY/ AIRCRAFT RELIABILITY/ AIRFOIL PROFILES/ TIP DRIVEN ROTORS/ WING LOADING

ABA: T.M.

ABS: A flight investigation produced data on performance and rotor loads for a teetering rotor, AH-1G helicopter flown with a main rotor that had the NLR-1 airfoil as the blade section contour. The test envelope included hover, forward flight speeds from 33 to 83 m/sec (65 to 162 knots), and collective fixed maneuvers at about 0.25 tip speed ratio. The data set for each test point describes vehicle flight state, control positions, rotor loads, power requirements, and blade motions. Rotor loads are reviewed primarily in terms of peak to peak and harmonic content. Lower frequency components predominated for most loads and generally increased with increased airspeed, but not necessarily with increased maneuver load factor. Detailed data for an advanced airfoil on an AH-1G are presented.

80N32333*# ISSUE 23 PAGE 3084 CATEGORY 2 RPT#:
NASA-TP-1701 L-13139 AVRADCOM-TR-80-B-5 CNT#: DA PROJ. 1L1-61102-AH-45 80/09/00 85 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Aerodynamic characteristics of three helicopter rotor airfoil sections at Reynolds number from model scale to full scale at Mach numbers from 0.35 to 0.90 --- conducted in Langley 6 by 28 inch transonic tunnel

AUTH: A/NOONAN, K. W.; B/BINGHAM, G. J.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Aviation Research and Development Command, St. Louis, Mo. AVAIL.NTIS SAP: HC A05/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
MAJS: /*AERODYNAMIC CHARACTERISTICS/*AIRFOILS/*HELICOPTERS/*REYNOLDS NUMBER/*WIND TUNNEL TESTS
MINS: / DRAG/ GRAPHS (CHARTS)/ MACH NUMBER/ SUPERCRITICAL FLOW/ TRAILING EDGES/ TRANSONIC WIND TUNNELS
ABA: R.K.G.
ABS: An investigation was conducted in the Langely 6 by 28 inch transonic tunnel to determine the two dimensional aerodynamic characteristics of three helicopter rotor airfoils at Reynolds numbers from typical model scale to full scale at Mach numbers from about 0.35 to 0.90. The model scale Reynolds numbers ranged from about 700,00 to 1,500,000 and the full scale Reynolds numbers ranged from about 3,000,000 to 6,600,000. The airfoils tested were the NACA 0012 (0 deg Tab), the SC 1095 R8, and the SC 1095. Both the SC 1095 and the SC 1095 R8 airfoils had trailing edge tabs. The results of this investigation indicate that Reynolds number effects can be significant on the maximum normal force coefficient and all drag related parameters; namely, drag at zero normal force, maximum normal force drag ratio, and drag divergence Mach number. The increments in these parameters at a given Mach number owing to the model scale to full scale Reynolds number change are different for each of the airfoils.

ORIGINAL PAGE IS OF POOR QUALITY

B1N11147*# ISSUE 2 PAGE 172 CATEGORY 24
80/08/00 22 PAGES UNCLASSIFIED DOCUMENT
UTTL: Composite components on commercial aircraft
AUTH: A/DEXTER, H. B.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A15/MF A01
In AGARD Effect of Serv. Environ. on Composite Mater. 22 p (SEE N81-11128 02-24)
MAJS: /*AIRCRAFT CONSTRUCTION MATERIALS/*COMMERCIAL AIRCRAFT/*COMPOSITE MATERIALS/*COMPOSITE STRUCTURES
MINS: / AIRCRAFT MAINTENANCE/ COMPONENT RELIABILITY/ FUEL CONSUMPTION/ SERVICE LIFE/ WEIGHT REDUCTION
ABA: J.M.S.
ABS: Flight experience gained with numerous composite aircraft structures is discussed. Both commercial transports and helicopters are included. Design concepts with significant mass savings and appropriate inspection and maintenance procedures are among the factors considered. Also, a major NASA/U.S. industry technology program to reduce fuel consumption of commercial transport aircraft through the use of advanced composites is described, including preliminary results. Ground and flight environmental effects on the composite materials used in the flight service programs are also discussed.

80A36325*# ISSUE 15 PAGE 2828 CATEGORY 71
RPT#: AIAA PAPER 80-0992 80/06/00 7 PAGES
UNCLASSIFIED DOCUMENT
UTTL: An overview of NASA's propeller and rotor noise research
AUTH: A/GREENE, G. C.; B/RANEY, J. P. PAA: B/(NASA. Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
American Institute of Aeronautics and Astronautics. Aeroacoustics Conference, 6th, Hartford, Conn., June 4-6, 1980. 7 p.
MAJS: /*AEROACOUSTICS/*AIRCRAFT NOISE/*NASA PROGRAMS/*NOISE REDUCTION/*PROPELLER DRIVE/*ROTARY WINGS
MINS: / FLIGHT TESTS/ HELICOPTERS/ NOISE PREDICTION (AIRCRAFT)/ WIND TUNNEL TESTS
ABA: (Author)
ABS: This paper presents a summary of NASA's propeller and rotor noise research. The objective of this research is to develop the technology and data base required to reduce propeller and rotor noise with minimum performance penalties. The status of current research will be described for both low- and high-speed propellers and for helicopter rotors. Recent results and future research thrusts are also discussed

80A35959*# ISSUE 14 PAGE 2606 CATEGORY 71
RPT#: AIAA PAPER 80-0996 80/06/00 14 PAGES
UNCLASSIFIED DOCUMENT
UTTL: A collection of formulas for calculation of rotating blade noise - Compact and noncompact source results
AUTH: A/FARASSAT, F. PAA: A/(NASA. Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
American Institute of Aeronautics and Astronautics. Aeroacoustics Conference, 6th, Hartford, Conn., June 4-6, 1980. 14 p.
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE GENERATORS/*ROTARY WINGS
MINS: / LINEAR EQUATIONS/ NOISE SPECTRA/ SOUND PRESSURE/ WAVE EQUATIONS
ABA: (Author)
ABS: A unified approach is used to derive many of the current formulations for calculation of discrete frequency noise for helicopter rotors and propellers.

Both compact and noncompact source formulations are derived. The compact formulations are obtained as the limit of noncompact source results. In particular, the linearized acoustic equations by Hawkings and Lowson, Farassat, Hanson, Woan and Gregorek, Succi, and Jou are derived in this paper. An interesting thickness noise formula by Isom and its recent extension to the near field by Ffowcs Williams are also presented. The paper includes some comparisons of measured and calculated acoustic pressure signatures and spectra for an advanced propeller. The theoretical results are obtained using a computer program developed by the author and P. A. Nystrom.

80A34840*# ISSUE 14 PAGE 2492 CATEGORY 5
80/06/00 31 PAGES UNCLASSIFIED DOCUMENT

UTTL: Current and projected use of carbon composites in United States aircraft

AUTH: A/LEONARD, R. W.; B/MULVILLE, D. R. PAA: A/(NASA, Langley Research Center, Hampton, Va.); B/(U.S. Navy, Naval Air Systems Command, Washington, D.C.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va ; Naval Air Systems Command, Washington, D. C.

NATO, AGARD, Specialists Meeting on Electromagnetic Effects of Carbon Composite Materials upon Avionics Systems, Lisbon, Portugal, June 16-19, 1980, Paper. 31 p.

MAJS: /*AIRCRAFT CONSTRUCTION MATERIALS/*AIRCRAFT STRUCTURES /*CARBON FIBERS/*COMMERCIAL AIRCRAFT/*FIBER COMPOSITES /*WINGS

MINS: / AIRFRAME MATERIALS/ AVIONICS/ FIGHTER AIRCRAFT/ GENERAL AVIATION AIRCRAFT/ HELICOPTERS/ STRUCTURAL WEIGHT/ SYSTEMS ENGINEERING/ UNITED STATES OF AMERICA

ABA: M.E.P.

ABS: It is noted that carbon composite materials are beginning to be used in commercial transports, general aviation aircraft, military fighter aircraft and helicopters due to demonstrated weight savings and potential manufacturing cost savings. Attention is given to current production applications of carbon composites which range from the secondary structures of new commercial transports to wing primary structures of fighters. Current development efforts are discussed that will lead to their future application to fuselages, as well as whole airframes. Finally, laminate constructions which vary widely, and may be relevant to avionics system design, are examined.

80N25296*# ISSUE 16 PAGE 2081 CATEGORY 2 RPT#: NASA-TP-1656 AVRADCOM-TR-80-B-3 L-13363 80/06/00 61 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development and validation of a combined rotor fuselage induced flow field computational method --- Langley V/STOL tunnel

AUTH: A/FREEMAN, C. E.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.. Army Aviation Research and Development Command, St. Louis, Mo. AVAIL.NTIS SAP: HC A04/MF A01
Prepared in cooperation with Army Aviation Research and Development Command, St Louis, Mo.

MAJS: /*COMPUTATIONAL FLUID DYNAMICS/*DOWNWASH/*HELICOPTER WAKES/*PANEL METHOD (FLUID DYNAMICS)/*ROTOR AERODYNAMICS/*WIND TUNNEL TESTS

MINS: / COMPUTER PROGRAMS/ FUSELAGES/ PRESSURE DISTRIBUTION/ VELOCITY DISTRIBUTION/ WIND TUNNEL MODELS

ABA: Author

ABS: A potential-flow panel method was modified to calculate the effects of a rotor wake on the time-averaged surface pressure and velocity distributions on a helicopter fuselage. The rotor-induced velocities are calculated by using a vortex-tube wake model. The calculated pressure distributions are found to compare well with experimental data obtained from tests of a wind-tunnel model.

80N23326*# ISSUE 14 PAGE 1803 CATEGORY 8 RPT#: NASA-TP-1649 L-13454 80/05/00 58 PAGES UNCLASSIFIED DOCUMENT

UTTL: Navigation, guidance, and control for helicopter automatic landings

AUTH: A/KELLY, J. R.; B/NIESSEN, F. R.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. SAP: HC A04/MF A01

MAJS: /*AUTOMATIC CONTROL/*AUTOMATIC LANDING CONTROL/* HELICOPTER CONTROL/*NAVIGATION AIDS

MINS: / AIRBORNE/SPACEBORNE COMPUTERS/ ALGORITHMS/ CH-47 HELICOPTER/ SYSTEMS ANALYSIS

ABA: A.W.H.

ABS: A navigation, guidance and control concept was developed for helicopter automatic approach and landings. The algorithms employed were implemented in an airborne digital computer installed on a CH-47B research helicopter. Data are presented to illustrate system performance during fully automatic approach and landings in a variety of wind conditions.

80N22321*# ISSUE 13 PAGE 1668 CATEGORY 6 RPT#: NASA-TM-80151 L-13136 80/05/00 40 PAGES UNCLASSIFIED DOCUMENT

UTTL: Pilot assessment of two computer-generated display formats for helicopter instrument approach

AUTH: A/NIESSEN, F. R.; B/DEAL, P. L.; C/PATTON, J. M., JR.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*ATTITUDE INDICATORS/*COMPUTERIZED SIMULATION/* DIRECTIONAL CONTROL/*DISPLAY DEVICES/*ELECTRONIC EQUIPMENT/*FLIGHT SIMULATORS/*HELICOPTER CONTROL

MINS: / COMMAND GUIDANCE/ CUES/ FLIGHT CONTROL/ HORIZONTAL ORIENTATION/ VERTICAL ORIENTATION

ABA: Author

ABS: Two computer generated display formats were evaluated as primary displays by six research pilots in a fixed base simulator. One of the computer generated display formats was an electronic attitude director indicator (EADI) which featured three cue flight director, command information, superimposed on true perspective runway symbology. The other computer generated display format featured separate horizontal and vertical situation information with vector predictors. A baseline display, consisting of an electromechanical attitude director indicator (ADI) with a three cue flight director and a moving map, was used as a reference for the pilot evaluations.

80A27597*# ISSUE 10 PAGE 1741 CATEGORY 5 80/04/00 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Composite components on commercial aircraft

AUTH: A/DEXTER, H. B. PAA: A/(NASA. Langley Research Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NATO, AGARD, Specialists Meeting on the Effect of Service Environment on Composite Materials, Athens, Greece, Apr. 13-18, 1980, Paper. 23 p.

MAJS: /*AIRCRAFT STRUCTURES/*BORON REINFORCED MATERIALS/* COMPOSITE STRUCTURES/*FLIGHT TESTS/*GRAPHITE-EPOXY COMPOSITES/ KEVLAR (TRADEMARK)

MINS: / AIRLINE OPERATIONS/ COMMERCIAL AIRCRAFT/ CONTROL SURFACES/ NASA PROGRAMS/ PRODUCT DEVELOPMENT/ ROTARY WINGS

ABA: A.T.

ABS: The paper considers the use of composite components in commercial aircraft. NASA has been active in sponsoring flight service programs with advanced composites for the last 10 years, with 2.5 million total composite component hours accumulated since 1970 on commercial transports and helicopters with no significant degradation in residual strength of composite components. Design, inspection, and maintenance procedures have been developed; a major NASA/US industry technology program has been developed to reduce fuel consumption of commercial transport aircraft through the use of advanced composites.

80N22304*# ISSUE 13 PAGE 1665 CATEGORY 5 RPT#: NASA-TM-81801 80/04/00 31 PAGES UNCLASSIFIED DOCUMENT

UTTL: Preliminary investigation of motion requirements for the simulation of helicopter hover tasks

AUTH: A/PARRISH, R. V.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*FLIGHT SIMULATION/*HELICOPTERS/*HOVERING

MINS: / ACCELERATION (PHYSICS)/ HEAVING/ MOTION/ PITCH (INCLINATION)

ABA: Author

ABS: Data from a preliminary experiment are presented which attempted to define a helicopter hover task that would allow the detection of objectively-measured differences in fixed base/moving base simulator performance. The addition of heave, pitch, and roll movement of a ship at sea to the hover task, by means of an adaption of a simulator g-seat, potentially fulfills the desired definition. The feasibility of g-seat substitution for platform motion can be investigated utilizing this task.

80N20223*# ISSUE 11 PAGE 1371 CATEGORY 1 RPT#: NASA-TM-81783 80/03/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Technology requirements and readiness for very large aircraft

AUTH: A/CONNER, D. W.; B/VAUGHAN, J. C., III

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*AERODYNAMIC CONFIGURATIONS/*AIRCRAFT DESIGN/* AIRCRAFT PERFORMANCE/*DYNAMIC STRUCTURAL ANALYSIS/* PROPULSIVE EFFICIENCY/*SYSTEMS ANALYSIS

MINS: / AERODYNAMIC CHARACTERISTICS/ AIR CUSHION LANDING SYSTEMS/ AIRCRAFT SAFETY/ HELICOPTER PERFORMANCE/ LANDING AIDS/ NOISE REDUCTION

ABA: Author

ABS: Common concerns of very large aircraft in the areas of economics, transportation system interfaces and operational problems were reviewed regarding their influence on vehicle configurations and technology. Fifty-four technology requirements were identified

which are judged to be unique, or particularly critical, to very large aircraft. The requirements were about equally divided among the four general areas of aerodynamics, propulsion and acoustics, structures, and vehicle systems and operations. The state of technology readiness was judged to be poor to fair for slightly more than one-half of the requirements. In the classic disciplinary areas, the state of technology readiness appears to be more advanced than for vehicle systems and operations.

80N18109*# ISSUE 9 PAGE 1103 CATEGORY 24 RPT#: NASA-TM-80231 80/03/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: Composite components on commercial aircraft
AUTH: A/DEXTER, H. B.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01
To be presented at the AGARD Specialist Meeting on Effect of Service Environ. on Composite Mater., Athens, 13-18 Apr. 1980
MAJS: /*AIRCRAFT STRUCTURES/*COMMERCIAL AIRCRAFT/*COMPOSITE STRUCTURES/*LIFE (DURABILITY)/*NASA PROGRAMS/* TECHNOLOGY ASSESSMENT
MINS: / BORON-EPOXY COMPOUNDS/ FUEL CONSUMPTION/ GRAPHITE-EPOXY COMPOSITES/ KEVLAR (TRADEMARK)/ STRUCTURAL WEIGHT/ WEIGHT REDUCTION
ABA: A.R.H.
ABS: Commercial aircraft manufacturers are making production commitments to composite structure for future aircraft and modifications to current production aircraft. Flight service programs with advanced composites sponsored by NASA during the past 10 years are described. Approximately 2.5 million total composite component flight hours have been accumulated since 1970 on both commercial transports and helicopters. Design concepts with significant mass savings were developed, appropriate inspection and maintenance procedures were established, and satisfactory service was achieved for the various composite components. A major NASA/U.S. industry technology program to reduce fuel consumption of commercial transport aircraft through the use of advanced composites was undertaken. Ground and flight environmental effects on the composite materials used in the flight service programs supplement the flight service evaluation.

80N20231*# ISSUE 11 PAGE 1372 CATEGORY 2 RPT#: NASA-TM-80232 80/02/00 53 PAGES UNCLASSIFIED DOCUMENT

UTTL: Operational implications of some NACA/NASA rotary wing induced velocity studies
AUTH: A/HEYSON, H. H.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A04/MF A01
Presented at 3d Midwest Helicopter Safety Seminar, Joliet, Ill., 26-27 Feb., 1980; sponsored by FAA and Ill. Dept. of Transportation.
MAJS: /*AIRCRAFT SAFETY/*FLOW DISTRIBUTION/*FLOW VELOCITY/* HELICOPTER WAKES
MINS: / AIRCRAFT ACCIDENTS/ AIRSPEED/ AUTOROTATION/ GROUND EFFECT (AERODYNAMICS)/ MOMENTUM THEORY
ABA: R.E.S.
ABS: Wind tunnel measurements show that the wake of a rotor, except at near-hovering speeds, is not like that of a propeller. The wake is more like that of a wing except that, because of the slow speeds, the wake velocities may be much greater. The helicopter can produce a wake hazard to following light aircraft that is disproportionately great compared to an equivalent fixed-wing aircraft. This hazard should be recognized by both pilots and airport controllers when operating in congested areas. Even simple momentum theory shows that, in autorotation and partial-power descent, the required power is a complex function of both airspeed and descent angle. The nonlinear characteristic, together with an almost total lack of usable instrumentation at low airspeeds, has led to numerous power-settling accidents. The same theory shows that there is a minimum forward speed at which a rotor can autorotate. Neglect of, or inadequate appraisal of this minimum speed has also led to numerous accidents. Ground effect and the problems it creates is discussed.

81A46352* ISSUE 22 PAGE 3913 CATEGORY 71 80/00/00 30 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aircraft noise control in the 1980's
AUTH: A/HUBBARD, H. H.; B/MORGAN, H. G. PAA: B/(NASA, Langley Research Center, Acoustics and Noise Reduction Div., Hampton, VA)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: Inter-noise 80: Noise control for the 80's; Proceedings of the Ninth International Conference on Noise Control Engineering, Miami, Fl., December 8-10, 1980. Volume 1. (A81-46351 22-71) Poughkeepsie, NY, Noise Control Foundation, 1980, p. 33-62.
MAJS: /*AIRCRAFT NOISE/*ENGINE NOISE/*JET AIRCRAFT NOISE/*

NOISE REDUCTION/*SONIC BOOMS
MINS: / AIRCRAFT ENGINES/ GENERAL AVIATION AIRCRAFT/ GOVERNMENT/INDUSTRY RELATIONS/ HELICOPTERS/ NOISE POLLUTION/ SUBSONIC AIRCRAFT/ SUPERSONIC AIRCRAFT
ABA: G.R.
ABS: It is pointed out that a need exists for the orderly development of technology and engineering methods for noise control of all types of aircraft. The nature and scope of aircraft noise problems are reviewed, and a description is provided of noise control progress made to date. The most serious aircraft noise problems confronting communities in the past two decades have been associated with the subsonic air carrier jet transport. Operational trends related to traffic growth and operational constraints are examined, and noise level trends are considered, taking into account engine cycle developments, the role of Federal noise certification, future noise exposures, and multiple noise sources. Advanced source noise reduction technology developments are discussed along with a noise impact assessment, and advanced operating procedures. Attention is also given to engine noise and sonic boom exposures in connection with supersonic air carrier aircraft, and exterior and interior noise control related to propeller/rotor aircraft.

81A43607* ISSUE 20 PAGE 3464 CATEGORY 5
80/00/00 23 PAGES UNCLASSIFIED DOCUMENT
UTTL: NASA service experience with composite components --- for aircraft structures
AUTH: A/DEXTER, H. B.; B/CHAPMAN, A. J. PAA: B/(NASA, Langley Research Center, Hampton, VA)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: Materials 1980: Proceedings of the Twelfth National Technical Conference, Seattle, WA, October 7-9, 1980. (A81-43601 20-23) Azusa, CA, Society for the Advancement of Material and Process Engineering, 1980, p. 77-99.
MAJS: /*AIRCRAFT DESIGN/*AIRCRAFT STRUCTURES/*COMPONENT RELIABILITY/*COMPOSITE MATERIALS/*FLIGHT TESTS/* PERFORMANCE TESTS
MINS: / AIRCRAFT MAINTENANCE/ COST REDUCTION/ FUEL CONSUMPTION/ HELICOPTER DESIGN/ INSPECTION/ RESEARCH AND DEVELOPMENT/ WEIGHT REDUCTION
ABA: (Author)
ABS: NASA Langley has been active in sponsoring flight service programs with advanced composites during the past decade. A broad data base and confidence in the durability of composite structures are being developed. Flight service experience is reported for more than 140 composite aircraft components with up to 8 years service and almost two million successful component flight hours. Composite components are being evaluated on Boeing, Douglas, and Lockheed transport aircraft. Components are currently under development for service evaluation on Bell and Sikorsky helicopters. Design concepts and inspection and maintenance results are reported for components currently in service. Components under development in the NASA Aircraft Energy Efficiency (ACEE) program are discussed. Results of flight, outdoor ground, and controlled laboratory environmental tests on composite materials used in the flight service programs are also presented.

81A42436*# ISSUE 19 PAGE 3254 CATEGORY 1
80/00/00 5 PAGES UNCLASSIFIED DOCUMENT
UTTL: Recommendations for the NASA Avionics program for the 1980's
AUTH: A/SPITZER, C. R.; B/BRUMMER, E. A.; C/JONES, W. R. PAA: C/(NASA, Langley Research Center, Avionics Planning Office, Hampton, VA)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: National Aerospace Symposium, Dayton, OH, March 11-13, 1980, Proceedings. (A81-42430 19-04) Washington, DC, Institute of Navigation, 1980, p. 85-89.
MAJS: /*AIRCRAFT CONTROL/*AVIONICS/*HUMAN FACTORS ENGINEERING/*MICROELECTRONICS/*NASA PROGRAMS
MINS: / COMMERCIAL AIRCRAFT/ GENERAL AVIATION AIRCRAFT/ ROTARY WING AIRCRAFT/ SYSTEMS INTEGRATION/ TECHNOLOGICAL FORECASTING/ V/STOL AIRCRAFT
ABA: G.R.
ABS: NASA is examining the merits of a significant expansion of its avionics, controls, and human factors technology program for the 1980's. The rationale for an expanded program is related to two factors. One factor is related to a utilization of recent and anticipated significant advances in microelectronics. The second factor is the need to develop new concepts in avionics and control systems for more efficient aircraft operation and better utilization of extremely limited airport capacity. Substantial benefits could be realized in three major categories, including improved aircraft efficiency, improved flight operations, and improved/extended operational capability. The NASA Avionics, Controls, and Human Factors Technology Plan is the report of a task force of agency personnel working in close cooperation with industry, DOD, and FAA. Attention is given to the NASA role, aircraft controls, crew station technology, flight management, integration and interfacing, commercial transports, general aviation, rotorcraft, V/STOL, and high performance aircraft.

81A20057*# ISSUE 7 PAGE 1124 CATEGORY 53
80/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Acceptance and control of aircraft interior noise and vibration

AUTH: A/STEPHENS, D. G.; B/LEATHERWOOD, J. D. PAA: B/(NASA, Langley Research Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

In: Symposium on Internal Noise in Helicopters, Southampton, England, July 17-20, 1979, Proceedings. (A81-20051 07-71) Southampton, England, University of Southampton, 1980, p. B2 1-B2 14.

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE REDUCTION/* PASSENGER AIRCRAFT/*VIBRATION DAMPING

MINS: / ACCELERATION (PHYSICS)/ CIVIL AVIATION/ COMFORT/ NOISE TOLERANCE/ RIDING QUALITY/ THRESHOLDS (PERCEPTION)

ABA: A.L.W.

ABS: Ride quality criteria for noise, vibration, and their combination in the helicopter cabin environment are discussed. Results are presented of laboratory and field studies of passenger responses to interior noise and vibration during the performance of a listening task and during reverie, as well as to the interaction of noise with multi-frequency and multi-axis vibration. A study of means for reducing helicopter interior noise based on analytical, experimental and flight studies of the near-field noise source characteristics of the aircraft, the transmission of noise through aircraft structures and the attenuation of noise by various noise control treatments is then presented which has resulted in a reduction of 3 dB in helicopter cabin noise. Finally, a model under development to evaluate passenger acceptance of a helicopter noise and vibration environment is indicated which incorporates the observed noise and vibration effects on comfort and is expected to provide insights for more effective noise and vibration control.

80N15875*# ISSUE 6 PAGE 796 CATEGORY 71 RPT#: NASA-TM-80200 79/12/00 96 PAGES UNCLASSIFIED DOCUMENT

UTTL: A summary and evaluation of semi-empirical methods for the prediction of helicopter rotor noise

AUTH: A/PEGG, R. J.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*PREDICTION ANALYSIS TECHNIQUES/*ROTARY WINGS

MINS: / AERODYNAMIC NOISE/ NOISE MEASUREMENT/ NOISE SPECTRA/ ROTOR AERODYNAMICS

ABA: M.G.

ABS: Existing prediction techniques are compiled and described. The descriptions include input and output parameter lists, required equations and graphs, and the range of validity for each part of the prediction procedures. Examples are provided illustrating the analysis procedure and the degree of agreement with experimental results.

80N14840*# ISSUE 5 PAGE 663 CATEGORY 71 RPT#: NASA-TP-1608 AVRADCOM-TR-80-B-1 L-13207 CNT#: DA PROJ. 1L2-62209-AH-76 79/12/00 80 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of helicopter noise due to b blade-vortex interaction for five tip configurations --- conducted in the Langley V/STOL tunnel

AUTH: A/HOAD, D. R.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Aviation Research and Development Command, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01

Prepared jointly with AVRADCOM, Hampton, Va.

MAJS: /*AIRCRAFT NOISE/*BLADE TIPS/*HELICOPTERS/*NOISE REDUCTION/*VORTICES

MINS: / AERODYNAMIC CONFIGURATIONS/ FLIGHT SIMULATION/ HELICOPTER DESIGN/ WAVE GENERATION

ABA: R.C.T.

ABS: The effect of tip shape modification on blade vortex interaction induced helicopter blade slap noise was investigated. Simulated flight and descent velocities which have been shown to produce blade slap were tested. Aerodynamic performance parameters of the rotor system were monitored to ensure properly matched flight conditions among the tip shapes. The tunnel was operated in the open throat configuration with treatment to improve the acoustic characteristics of the test chamber. Four promising tips were used along with a standard square tip as a baseline configuration. A detailed acoustic evaluation on the same rotor system of the relative applicability of the various tip configurations for blade slap noise reduction is provided.

80N13769*# ISSUE 4 PAGE 517 CATEGORY 53 RPT#: NASA-TP-1590 L-13233 79/12/00 26 PAGES UNCLASSIFIED DOCUMENT

UTTL: Effect of noise spectra and a listening task upon passenger annoyance in a helicopter interior noise environment

AUTH: A/CLEVENSON, S. A.; B/LEATHERWOOD, J. D.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC

A03/MF A01
MAJS: /*AIRCRAFT NOISE/*AUDITORY PERCEPTION/*HELICOPTERS/*HUMAN REACTIONS/*NOISE TOLERANCE
MINS: / AUDITORY TASKS/ CIVIL AVIATION/ HUMAN FACTORS ENGINEERING/ SOUND PRESSURE
ABA: R.E.S.
ABS: The effects of helicopter interior noise on passenger annoyance were studied. Both reverie and listening situations were studied as well as the relative effectiveness of several descriptors (i.e., overall sound pressure level, A-weighted sound pressure level, and speech interference level) for quantifying annoyance response for these situations. The noise stimuli were based upon recordings of the interior noise of a civil helicopter research aircraft. These noises were presented at levels ranging from approximately 68 to 86 dB(A) with various gear clash tones selectively attenuated to give a range of spectra. Results indicated that annoyance during a listening condition is generally higher than annoyance during a reverie condition for corresponding interior noise environments. Attenuation of the planetary gear clash tone results in increases in listening performance but has negligible effect upon annoyance for a given noise level. The noise descriptor most effective for estimating annoyance response under conditions of reverie and listening situations is shown to be the A-weighted sound pressure level.

79A51090*# ISSUE 23 PAGE 4261 CATEGORY 9
79/11/00 9 PAGES UNCLASSIFIED DOCUMENT
UTTL: A real-time simulation facility for advanced digital guidance and control system research
AUTH: A/BRYANT, W. H.; B/DOWNING, D. R.; C/OSTROFF, A. J.
PAA: C/(NASA, Langley Research Center, Flight Electronics Div., Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
Institute of Electrical and Electronics Engineers and American Institute of Aeronautics and Astronautics, Digital Avionics Systems Conference, Fort Worth, Tex., Nov. 6-8, 1979, Paper, 9 p.
MAJS: /*AIRCRAFT LANDING/*DIGITAL SIMULATION/*FLIGHT SIMULATION/*HELICOPTERS/*REAL TIME OPERATION
MINS: / ALGORITHMS/ BLOCK DIAGRAMS/ CONTROLLERS/ GRAPHS (CHARTS)/ SYSTEMS ENGINEERING/ TRAJECTORY ANALYSIS
ABA: M.E.P.
ABS: A real-time simulation facility built at NASA's Langley Research Center to support digital guidance and control research and development activities is examined. The unit has recently been used to develop autoland systems for VTOL. The paper describes the autoland experiment and the flight environment, the simulation facility hardware and software, and presents typical simulation data to illustrate the type of data analysis carried out during software development. Finally, flight data for a later version of the autoland system are presented to demonstrate the simulation's capability to predict overall system behavior.

79N27097*# ISSUE 18 PAGE 2358 CATEGORY 2 RPT#: NASA-TM-80112 79/06/00 114 PAGES UNCLASSIFIED DOCUMENT
UTTL: A flight investigation of basic performance characteristics of a teetering-rotor attack helicopter
AUTH: A/MORRIS, C. E. K., JR.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A06/MF A01
Sponsored in part by the US Army Aviation Research and Development Command, Hampton, Va.
MAJS: /*AERODYNAMIC CHARACTERISTICS/*FLIGHT TESTS/*HELICOPTER PERFORMANCE/*MILITARY HELICOPTERS/*ROTOR AERODYNAMICS/*TEETERING
MINS: / DATA REDUCTION/ GRAPHS (CHARTS)/ IN-FLIGHT MONITORING/ ROTARY WINGS/ TABLES (DATA)
ABA: Author
ABS: Flight data were obtained with an instrumented AH-16 helicopter having uninstrumented, standard main-rotor blades. The data are presented to facilitate the analysis of data taken when the same vehicle was flown with instrumented main-rotor blades built with new airfoils. Test results include data on performance, flight-state parameters, pitch-link loads and blade angles for level flight, descending turns and pull-ups. Flight test procedures and the effects of both trim variations and transient phenomena on the data are discussed.

79N26782*# ISSUE 17 PAGE 2316 CATEGORY 53 RPT#: NASA-TM-80106 79/06/00 18 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effect of helicopter noise on passenger annoyance
AUTH: A/CLEVENSON, S. A.; B/LEATHERWOOD, J. D.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01
Presented at 97th Meeting of the Acoust. Soc. of AAm., Cambridge, Mass., 11-15 Jun. 1979
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*HUMAN TOLERANCES
MINS: / AUDITORY PERCEPTION/ NOISE TOLERANCE/ PHONETICS/ PITCH
ABA: R.E.S.
ABS: The effects of helicopter interior noise on passenger

annoyance for both reverie and listening situations was investigated. The relative effectiveness of several metrics for quantifying annoyance response for these situations was also studied. The noise stimuli were based upon recordings of the interior noise of civil helicopter research aircraft. These noises were presented at levels ranging from approximately 70 to 86 d with various tonal components selectively attenuated to give a range of spectra. The listening task required the subjects to listen to and record phonetically-balanced words presented within the various noise environments. Results indicate that annoyance during a listening condition is generally higher than annoyance under a reverie condition for corresponding interior noise environments. Attenuation of the tonal components results in increases in listening performance but has only a small effect upon annoyance for a given noise level.

79N25844*# ISSUE 16 PAGE 2191 CATEGORY 71
RPT#: NASA-TM-80066 79/05/00 464 PAGES
UNCLASSIFIED DOCUMENT

UTTL: An experimental investigation of the effect of rotor tip shape on helicopter blade-slap noise --- in the langley v/stol wind tunnel
AUTH: A/HOAD, D. R.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Research and Technology Labs., Fort Eustis, Va. AVAIL.NTIS SAP: HC A20/MF A01
Prepared in cooperation with Army Res. and Technol. Labs., Hampton, Va.
MAJS: /*AIRCRAFT NOISE/*BLADE TIPS/*HELICOPTERS/*ROTARY WINGS/*ROTOR AERODYNAMICS/*WIND TUNNEL TESTS
MINS: / ACOUSTIC MEASUREMENT/ AERODYNAMIC CHARACTERISTICS/ AIRFOIL PROFILES/ NOISE REDUCTION
ABA: A.R.H.
ABS: The effect of tip-shape modification on blade-vortex interaction-induced helicopter blade-slap noise was investigated. The general rotor model system (GRMS) with a 3.148 m (10.33 ft) diameter, four-bladed fully articulated rotor was installed in the Langley V/STOL wind tunnel. The tunnel was operated in the open-throat configuration with treatment to improve the semi-anechoic characteristics of the test chamber. Based on previous investigation, four promising tips (slee, sub-wing, [illegible] deg swept-tapered, and end-plate) were used along with a standard square tip as a baseline configuration. Aerodynamic and acoustical data concerning the relative applicability of the various tip configurations for blade-slap noise reduction are presented without analysis or discussion.

79N23080*# ISSUE 14 PAGE 1805 CATEGORY 6 RPT#: NASA-TM-80069 L-12505 79/05/00 16 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Comparison of electromechanical and cathode-ray-tube display mediums for an instrument approach display
AUTH: A/ABBOTT, T. S.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01
MAJS: /*CATHODE RAY TUBES/*DISPLAY DEVICES/*ELECTROMECHANICAL DEVICES/*FLIGHT INSTRUMENTS
MINS: / COLOR/ DIMENSIONS/ FLIGHT SIMULATION/ FLIGHT TESTS/ HELICOPTERS/ PILOT PERFORMANCE/ QUALITATIVE ANALYSIS
ABA: S.E.S.
ABS: The effect on pilot performance of replacing a single electromechanical display with similar cathode-ray-tube displays was studied. The effects of dimensionality, color, and shading were evaluated with respect to the pilot's ability to interpret and respond to displayed information.

79A49347*# ISSUE 22 PAGE 4178 CATEGORY 43
79/04/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Remote sensing of phytoplankton density and diversity in Narragansett Bay using an airborne fluorosensor
AUTH: A/FARMER, F. H.; B/BROWN, C. A., JR.; C/JARRETT, O., JR.; D/CAMPBELL, J. W.; E/STATON, W. L. PAA: E/(NASA, Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
International Symposium for Remote Sensing of Environment, 13th, Ann Arbor, Mich., Apr. 23-27, 1979. Paper. 14 p.
MAJS: /*AIRBORNE EQUIPMENT/*BAYS (TOPOGRAPHIC FEATURES)/*DENSITY MEASUREMENT/*FLUORESCENCE/*PLANKTON/*REMOTE SENSORS
MINS: / ALGAE/ CHLOROPHYLLS/ DYE LASERS/ HELICOPTERS/ RHODE ISLAND/ SEA-TRUTH/ SYNOPTIC MEASUREMENT/ VARIATIONS/ WATER POLLUTION/ WATER RESOURCES
ABA: C.F.W.
ABS: An aircraft-borne remote system is presented that utilizes narrow-band light from multiple dye lasers to excite selected algae photopigments and then measures the resultant flourescence emitted from chlorophyll a at 685 nm. Tests were conducted with both pure and mixed cultures of marine algae from a series of field tests taken from rivers and bridges of Narragansett Bay, and a prototype remote fluorosensor was flown over the Bay during the 1978 winter-spring diatom bloom. Remote fluorescence obtained at hover points over sea-truth stations showed correlations with in situ fluorescence, total chlorophyll a, and cell count. It was concluded that the ratio of remote

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fluorescence to direct chlorophyll a concentration was less variable than expected, and the distribution of total chlorophyll a between two major photoplankton color groups showed three distinct areas, within the Bay, of green and golden-brown species.

79N23754*# ISSUE 14 PAGE 1902 CATEGORY 71
RPT#: NASA-TM-80084 79/04/00 16 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Physical and subjective studies of aircraft interior noise and vibration
AUTH: A/STEPHENS, D. G.; B/LEATHERWOOD, J. D.
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01
To be presented at Symp. on Internal Noise in Helicopters, Southampton, England, 17-20 Jul. 1979
MAJS: /*AIRCRAFT COMPARTMENTS/*NOISE TOLERANCE/*PASSENGERS/*RIDING QUALITY/*VIBRATION PERCEPTION
MINS: / AIRCRAFT NOISE/ AUDITORY STIMULI/ COMFORT/ HELICOPTERS/ NOISE REDUCTION/ VIBRATION DAMPING
A3A: A.R.H.
ABS: Measurements to define and quantify the interior noise and vibration stimuli of aircraft are reviewed as well as field and simulation studies to determine the subjective response to such stimuli, and theoretical and experimental studies to predict and control the interior environment. In addition, ride quality criteria/standards for noise, vibration, and combinations of these stimuli are discussed in relation to the helicopter cabin environment. Data on passenger response are presented to illustrate the effects of interior noise and vibration on speech intelligibility and comfort of crew and passengers. The interactive effects of noise with multifrequency and multiaxis vibration are illustrated by data from LaRC ride quality simulator. Constant comfort contours for various combinations of noise and vibration are presented and the incorporation of these results into a user-oriented model are discussed. With respect to aircraft interior noise and vibration control, ongoing studies to define the near-field noise, the transmission of noise through the structure, and the effectiveness of control treatments are described.

79N24958*# ISSUE 16 PAGE 2070 CATEGORY 2 RPT#: NASA-CASE-LAR-12396-1 US-PATENT-APPL-SN-017889 79/03/06 21 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter rotor airfoil TLSP: Patent Application
AUTH: A/BINGHAM, G. J. PAT: A/Inventor (to NASA)
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01
MAJS: /*AIRCRAFT DESIGN/*HELICOPTERS/*ROTARY WINGS/*ROTOR BLADES (TURBOMACHINERY)
MINS: / AERODYNAMIC COEFFICIENTS/ AIRCRAFT PERFORMANCE/ AIRFOIL PROFILES/ PATENT APPLICATIONS/ PROPELLER BLADES/ ROTOR LIFT
ABA: NASA
ABS: An airfoil which has particular application to the blade or blades of rotor aircraft and aircraft propellers is presented. The airfoil thickness distribution, camber and leading edge radius are shaped to locate the airfoil crest at a more aft position along the chord, and to increase the freestream Mach number at which sonic flow is attained at the airfoil crest. The reduced slope of the airfoil causes a reduction in velocity at the airfoil crest at lift coefficients from zero to the maximum lift coefficient. The leading edge radius is adjusted so that the maximum local Mach number at 1.25 percent chord and at the designed maximum lift coefficient is limited to about 0.48 when the Mach number normal to the leading edge is approximately 0.20. The lower surface leading edge radius is shaped so that the maximum local Mach number at the leading edge is limited to about 0.29 when the Mach number normal to the leading edge is approximately 0.20. The drag divergence Mach number associated with the airfoil is moved to a higher Mach number over a range of lift coefficients resulting in superior aircraft performance.

79A26876*# ISSUE 10 PAGE 1677 CATEGORY 71
RPT#: AIAA PAPER 79-0608 CNT#: NSG-1474 79/03/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: A comparison of linear acoustic theory with experimental noise data for a small-scale hovering rotor
AUTH: A/FARASSAT, F.; B/MORRIS, C. E. K., JR.; C/NYSTROM, P. A. FAA: A/(Joint Institute for Advancement of Flight Sciences, Hampton, Va.); B/(NASA, Langley Research Center, Hampton, Va.); C/(NASA, Langley Research Center; Joint Institute for Advancement of Flight Sciences, Hampton, Va.)
CORP: Joint Inst. for Advancement of Flight Sciences, Hampton, Va.; National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 5th, Seattle, Wash., Mar. 12-14, 1979. 10 p. Army-supported research;
MAJS: /*AEROACOUSTICS/*AERODYNAMIC NOISE/*AIRCRAFT NOISE/*HOVERING/*NOISE MEASUREMENT/*ROTOR AERODYNAMICS
MINS: / ACOUSTIC PROPAGATION/ HELICOPTER PERFORMANCE/ ROTARY WINGS/ SCALE MODELS/ SOUND FIELDS

ABA: S.D.
ABS: Linear acoustic calculations based on full aerodynamic data as input are presented and compared with measured cases reported by Boxwell et al. (1978). The full aerodynamic data are obtained using three programs giving radial loading, chordwise loading, and chordwise position of transition. It is shown that in the theoretical results the most significant noise source mechanism is due to blade thickness. Thus the conclusions of Boxwell et al. as to the importance of nonlinearities around the blades are upheld. These conclusions concern the width, shape and the level of the acoustic pressure calculated from linear acoustic theory. Some of the approximations involved in the application of acoustic analogy using quadrupole sources are discussed. It is necessary that the near- and far-field problems of rotating blades be treated together as shown for the case of an oscillating sphere.

79N26015*# ISSUE 17 PAGE 2216 CATEGORY 2 RPT#: NASA-TM-80051 79/03/00 170 PAGES UNCLASSIFIED DOCUMENT
UTTL: Fuselage surface pressure measurements of a helicopter wind-tunnel model with a 3.15-meter diameter single rotor
AUTH: A/FREEMAN, C. E.; B/MINECK, R. E.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A08/MF A01
MAJS: /*FUSELAGES/*HELICOPTERS/*PRESSURE MEASUREMENT
MINS: / ROTARY WINGS/ WIND TUNNEL MODELS/ WIND TUNNEL TESTS
ABA: Author
ABS: A wind-tunnel investigation was conducted to measure the time averaged fuselage surface pressures of a helicopter model with a 3.15 meter diameter, four-bladed articulated rotor. Measurements were made at hover and advance ratios of 0.05, 0.15, and 0.20 for a range of thrusts. Data are presented with no analysis.

79N15970*# ISSUE 7 PAGE 820 CATEGORY 6 RPT#: NASA-TP-1397 L-11836 79/01/00 35 PAGES UNCLASSIFIED DOCUMENT
UTTL: Design and analysis of an active jet control system for helicopter sling loads TLSP: M.S. Thesis - Old Dominion Univ.
AUTH: A/PARDUE, M. D.; B/SHAUGHNESSY, J. D.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01
MAJS: /*HELICOPTERS/*JET CONTROL/*MATERIALS HANDLING
MINS: / DAMPING/ FEEDBACK CONTROL/ SIMULATION/ STABILIZATION
ABA: Author
ABS: An active jet control system for stabilizing the swinging motion of helicopter external sling loads in hover (and forward flight) is described. A velocity feedback control law is obtained by using classical control theory. A nondimensional analysis is performed to give a simple chart for determining the appropriate value of feedback gain as a function of cable length, sling length, and load parameters to provide theoretical damping ratios of 0.7. The sensitivity to parameter changes was studied, and + or - a 10 percent change in parameters was found to affect system performance only slightly. Implementation of the control scheme in a nonlinear simulation produced damping ratios equal to or greater than those calculated. A limited number of piloted flights in a visual simulator indicated a significant reduction in load swinging in the transition to hover, and thus the pilot was able to concentrate on load altitude and position control.

80A23460*# ISSUE 8 PAGE 1328 CATEGORY 3 79/00/00 15 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter /RSRA/ in-flight escape system - Component qualification
AUTH: A/BENENT, L. J. PAA: A/(NASA. Langley. Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: Symposium on Explosives and Pyrotechnics, 10th, San Francisco, Calif., February 14-16, 1979. Proceedings. (A80-23459 08-28) Philadelphia, Pa., Franklin Research Center, 1979, p. 7-1 to 7-15.
MAJS: /*AIRCRAFT PARTS/*AIRCRAFT RELIABILITY/*ESCAPE SYSTEMS /*FLIGHT SAFETY/*HELICOPTER DESIGN/*ROTOR SYSTEMS RESEARCH AIRCRAFT
MINS: / CANOPIES/ ENVIRONMENTAL TESTS/ FIRE CONTROL/ FLIGHT TESTS/ MILITARY AIRCRAFT/ QUALITY CONTROL/ ROTOR BLADES/ SAFETY FACTORS/ SEATS
ABA: B.J.
ABS: The paper describes the design, development, and qualification approach for the RSRA (Rotor Systems Research Aircraft) system explosive and pyrotechnic components. The approach was based on previous experience and included: (1) the application of good design practice and quality control, (2) a thorough examination of component interfaces through demonstration testing of functional margins, (3) the carrying out of thorough real-world sequential environmental testing, and (4) the operation of environmentally exposed units in subsystem-level tests at temperature, force, and energy limits. Owing

largely to this approach, the RSRA became the first helicopter system to contain a fully qualified and operational in-flight escape system.

79A33626* ISSUE 13 PAGE 2326 CATEGORY 3
79/00/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter emergency escape
AUTH: A/BEMENT, L. J. PAA: A/(NASA. Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: Survival and Flight Equipment Association, Annual Symposium, 16th, San Diego, Calif., October 8-12, 1978, Proceedings. (A79-33601 13-03) Canoga Park, Calif., Survival and Flight Equipment Association, 1979, p. 155-164.
MAJS: /*DESIGN ANALYSIS/*ESCAPE SYSTEMS/*HELICOPTER PERFORMANCE/*ROTOR SYSTEMS RESEARCH AIRCRAFT
MINS: / EGRESS/ FLIGHT SAFETY/ LONGITUDINAL CONTROL/ SLEDS
ABA: (Author)
ABS: The three-man Rotor Systems Research Aircraft (RSRA) Emergency Escape System, the first system known to be fully qualified and operational in a rotary wing aircraft, will have two modes of operation: one providing for full in-flight egress, and the other for the severance of the rotor blades for a return to base as a fixed-wing aircraft. This paper describes the escape system's design principles, integration into the aircraft, qualification, and performance.

80N21283*# ISSUE 12 PAGE 1514 CATEGORY 2 RPT#: NASA-CP-2046 L-12232 79/00/00 262 PAGES UNCLASSIFIED DOCUMENT
UTTL: Advanced technology airfoil research, volume 2 --- conferences
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A12/MF A01
Presented at conf., Langley Research Center, Hampton, Va. 7-9 Mar. 1978
MAJS: /*AIRFOILS/*CONFERENCES/*TECHNOLOGY ASSESSMENT/*TECHNOLOGY UTILIZATION
MINS: / AERODYNAMIC CHARACTERISTICS/ COMPUTERIZED DESIGN/ GENERAL AVIATION AIRCRAFT/ ROTARY WING AIRCRAFT/ STRUCTURAL DESIGN/ SYSTEMS ENGINEERING/ TEST FACILITIES
ABA: R.E.S.
ABS: A comprehensive review of airfoil research is presented. The major thrust of the research is in three areas: development of computational aerodynamic codes for airfoil analysis and design, development of experimental facilities and test techniques, and all types of airfoil applications.

79N14382* ISSUE 5 PAGE 600 CATEGORY 37 RPT#: NASA-CASE-LAR-11900-1 US-PATENT-4,111,068 US-PATENT-APPL-SN-775239 US-PATENT-CLASS-74-586 US-PATENT-CLASS-403-105 US-PATENT-CLASS-416-61
78/09/05 6 PAGES UNCLASSIFIED DOCUMENT
Filed 7 Mar. 1977 Supersedes N77-18134 (15 - 09, p 1130)
UTTL: Locking redundant link TLSP: Patent
AUTH: A/BONISCH, F. H. PAA: A/(Sikorsky Aircraft, Stratford, Conn.) PAT: A/inventor (to NASA)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Sikorsky Aircraft, Stratford, Conn. SAP: Avail: US Patent and Trademark Office
Sponsored by NASA
MAJS: /*COEFFICIENT OF FRICTION/*COMPRESSION LOADS/*LINKAGES /*ROTARY WINGS/*STRUTS
MINS: / AIRFRAMES/ AXIAL LOADS/ HELICOPTER TAIL ROTORS/ PATENTS/ TENSILE STRESS
ABA: Official Gazette of the U.S. Patent and Trademark Office
ABS: A low-friction, axially extensible strut, automatically lockable in both tension and compression, for use as a secondary load path in helicopter main rotor force measurement systems is described.

79A11550* ISSUE 1 PAGE 7 CATEGORY 3 78/09/00
13 PAGES UNCLASSIFIED DOCUMENT
UTTL: Potential applications of advanced aircraft in developing countries
AUTH: A/MADDALON, D. V. PAA: A/(NASA, Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
Society of Automotive Engineers, International Forum for Air Cargo, 9th, Vancouver, Canada, Sept. 26-28, 1978, Paper. 15 p.
MAJS: /*AIR TRANSPORTATION/*CIVIL AVIATION/*DEVELOPING NATIONS/*TECHNOLOGY UTILIZATION
MINS: / AIRPORT PLANNING/ AIRSHIPS/ BRAZIL/ ECONOMIC FACTORS / HELICOPTERS/ INDONESIA
ABA: G.R.
ABS: An investigation sponsored by NASA indicates that air transportation can play an important role in the economic progress of developing countries. By the turn of the century, the rapid economic growth now occurring in many developing countries should result in a major redistribution of the world's income. Some countries now classified as 'developing' will become

'developed' and are likely to become far more important to the world's civil aviation industry. Developing countries will be increasingly important buyers of conventional subsonic long-haul jet passenger aircraft but not to the point of significant influence on the design or technological content of future aircraft of this type. However, the technological content of more specialized aircraft may be influenced by developing country requirements and reflected in designs which fill a need concerning specialized missions, related to short-haul, low-density, rough runways, and natural resource development.

78A45439*# ISSUE 20 PAGE 3607 CATEGORY 5
78/09/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: VALT parameter identification flight test --- VTOL Approach and Landing Technology
AUTH: A/TOMAINE, R. L.; B/BRYANT, W. H.; C/HODGE, W. F.
PAA: A/(U.S. Army, Structures Laboratory, Hampton, Va.); C/(NASA, Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Structures Lab., Hampton, Va.
Associazione Italiana di Aeronautica ed Astronautica and Associazione Aerospaziali, European Rotorcraft and Powered Lift Aircraft Forum, 4th, Stresa, Italy, Sept. 13-15, 1978, Paper. 14 p.
MAJS: /*AIRCRAFT LANDING/*APPROACH/*FLIGHT TESTS/* HELICOPTERS/*VERTICAL TAKEOFF AIRCRAFT
MINS: / AERODYNAMIC COEFFICIENTS/ CH-47 HELICOPTER/ NASA PROGRAMS/ PARAMETERIZATION/ TEST FACILITIES
ABA: P.T.H.
ABS: The paper describes a method of establishing the accuracy of previously developed analytical models of research vehicles for a program for developing avionics technology for VTOL aircraft. The research vehicle is a Boeing-Vertol CH-47 tandem rotor transport helicopter equipped with a fly-by-wire control system. The specialized flight test was designed to take into account the presence of winds at flight conditions from hover through transition to cruise. The test provided data to obtain estimates of derivatives by parameter identification.

79N10863*# ISSUE 1 PAGE 114 CATEGORY 71
78/08/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Trends in Langley helicopter noise research
AUTH: A/HUBBARD, H. H.; B/MAGLIERI, D. J.; C/STEPHENS, D. G.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A19/MF A01
In its Helicopter Acoustics, Pt. 2 p 781-796 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE REDUCTION/* RESEARCH MANAGEMENT
MINS: / AIRCRAFT COMPARTMENTS/ CIVIL AVIATION/ ENVIRONMENT EFFECTS/ NASA PROGRAMS/ PASSENGER AIRCRAFT
ABA: J.M.S.
ABS: A broad perspective of needs in helicopter exterior and interior control is presented. Emphasis is given to those items which support noise certification of civil helicopters and which result in reduced environmental noise impact to community residents as well as to helicopter passengers. The activities described are related to the Langley responsibilities for helicopter acoustics as defined by NASA roles and missions.

79N10848*# ISSUE 1 PAGE 112 CATEGORY 71
78/08/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Human response to aircraft-noise-induced building vibration
AUTH: A/CAWTHORN, J. M.; B/DEMPSEY, T. K.; C/BEILOACH, R.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A19/MF A01
In its Helicopter Acoustics, Pt. 2 p 479-491 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT NOISE/*BUILDINGS/*HUMAN REACTIONS/* PSYCHOACOUSTICS/*STRUCTURAL VIBRATION
MINS: / HELICOPTERS/ HUMAN TOLERANCES/ NOISE TOLERANCE/ THRESHOLDS (PERCEPTION)
ABA: J.M.S.
ABS: The effects of noise induced building structure vibration and the rattle of objects on human response to aircraft flyover noise were investigated in a series of studies conducted in both the field and the laboratory. The subjective detection thresholds for vibration and rattle were determined as well as the effect of vibration and rattle upon aircraft noise annoyance.

79N10847*# ISSUE 1 PAGE 112 CATEGORY 71
78/08/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Annoyance due to simulated blade-slap noise
AUTH: A/POWELL, C. A.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A19/MF A01
In its Helicopter Acoustics, Pt. 2 p 463-477 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE TOLERANCE/*

PSYCHOACOUSTICS/*ROTARY WINGS
MINS: / CORRECTION/ EFFECTIVE PERCEIVED NOISE LEVELS/ HUMAN REACTIONS/ HUMAN TOLERANCES/ IMPULSES/ SOUND PRESSURE/ STATISTICAL CORRELATION
ABA: J.M.S.
ABS: The effects of several characteristics of blade slap noise on annoyance response were studied. These characteristics or parameters were the sound pressure level of the continuous noise used to simulate helicopter broadband noise, the ratio of impulse peak to broadband noise or crest factor, the number of pressure excursions comprising an impulse event, the rise and fall time of the individual impulses, and the repetition frequency of the impulses. Analyses were conducted to determine the correlation between subjective response and various physical measures for the range of parameters studied. A small but significant improvement in the predictive ability of PNL was provided by an A-weighted crest factor correlation. No significant improvement in predictive ability was provided by a rate correction.

79N10843*# ISSUE 1 PAGE 112 CATEGORY 71 RPT#: N4SA-CP-2052-PT-2 L-12339-PT-2 78/08/00 438 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter Acoustics, part 2 --- conferences
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A19/MF A01
Presented at the Intern. Specialists Symp., Hampton, Va., 22-24 May 1978; sponsored by the Am. Helicopter Soc. and AROD
MAJS: /*AEROACOUSTICS/*AIRCRAFT NOISE/*CONFERENCES/*HELICOPTERS
MINS: / AUDITORY FATIGUE/ HUMAN FACTORS ENGINEERING/ NOISE REDUCTION/ PREDICTION ANALYSIS TECHNIQUES/ ROTARY WINGS/ ROTOR AERODYNAMICS
ANN: Exterior and interior helicopter noise problems are addressed from the physics and engineering as well as the human factors point of view. Noise regulation concepts, human factors and criteria, rotor noise generation and control, design, operations and testing for noise control, helicopter noise prediction, and research tools and measurements are covered. For individual titles, see N79-10844 through N79-10864.

78N32830*# ISSUE 23 PAGE 3138 CATEGORY 71 78/08/00 32 PAGES UNCLASSIFIED DOCUMENT
UTTL: Full-scale testing of an Ogee tip rotor --- in the Langley whirl tower
AUTH: A/MANTAY, W. R.; B/CAMPBELL, R. L.; C/SHIDLER, P. A.
PAA: A/(AVRADCOM Res. and Technol. Labs.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A17/MF A01
In its Helicopter Acoustics p 277-308 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*BLADE TIPS/*HELICOPTERS/*OGEE SHAPE/*ROTARY WINGS/*WING TIPS
MINS: / AEROACOUSTICS/ NOISE POLLUTION/ NOISE REDUCTION/ POLLUTION CONTROL/ ROTOR AERODYNAMICS/ VORTICES
ABA: J.M.S.
ABS: Full scale tests were utilized to investigate the effect of the ogee tip on helicopter rotor acoustics, performance, and loads. Two facilities were used: the Langley whirl tower and a UH-1H helicopter. The test matrix for hover on the whirl tower involved thrust values from 0 to 44 480 N (10,000 lb) at several tip Mach numbers for both standard and Ogee rotors. The full scale testing on the UH-1H encompassed the major portion of the flight envelope for that aircraft. Both near field acoustic measurements and far field flyover data were obtained for both the ogee and standard rotors. Data analysis of the whirl tower test shows that the ogee tip does significantly diffuse the tip vortex while providing some improvement in hover performance at low and moderate thrust coefficients. Flight testing of both rotors indicates that the strong impulsive noise signature of the standard rotor can be reduced with the ogee rotor. Analysis of the spectra indicates a reduction in energy in the 250 Hz and 1000 Hz range for the ogee rotor. Forward flight performance was significantly improved with the ogee configuration for a large number of flight conditions. Further, rotor control loads were reduced through use of this advanced tip rotor.

78N32827*# ISSUE 23 PAGE 3138 CATEGORY 71 78/08/00 15 PAGES UNCLASSIFIED DOCUMENT
UTTL: Exploratory wind-tunnel investigation of the effect of the main rotor wake on tail rotor noise --- langley anechoic noise facility
AUTH: A/PEGG, R. J.; B/SHIDLER, P. A.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A17/MF A01
In its Helicopter Acoustics p 205-219 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*ROTARY WINGS/*TAIL ROTORS/*WAKES/*WIND TUNNEL TESTS
MINS: / AEROACOUSTICS/ HELICOPTER DESIGN/ NOISE POLLUTION/ NOISE REDUCTION/ POLLUTION CONTROL/ VORTICES
ABA: J.M.S.
ABS: Approaches to minimizing the noise generated by the interaction of the tail rotor blades with the wake of

the main rotor considered include repositioning of the tail rotor with respect to the main rotor, changes in the rotational direction of the tail rotor, and modification of the main rotor tip vortex. A variable geometry model was built which had the capability of varying tail rotor position relative to the main rotor as well as direction of tail rotor rotation. Acoustic data taken from the model in the Langley anechoic noise facility indicates interaction effects due to both main rotor shed vortex and the main rotor turbulence.

78N32826*# ISSUE 23 PAGE 3137 CATEGORY 71
78/08/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter noise research at the Langley V/STOL tunnel
AUTH: A/HOAD, D. R.; B/GREEN, G. C. PAA: A/(AVRADCOM Res. and Technol. Labs.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A17/MF A01
In its Helicopter Acoustics p 181-204 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*V/STOL AIRCRAFT/*WIND TUNNEL TESTS
MINS: / AERODYNAMIC CONFIGURATIONS/ FLIGHT TESTS/ NOISE POLLUTION/ NOISE REDUCTION/ POLLUTION CONTROL
ABA: J.M.S.
ABS: The noise generated from a 1/4-scale AH-1G helicopter configuration was investigated in the Langley V/STOL tunnel. Microphones were installed in positions scaled to those for which flight test data were available. Model and tunnel conditions were carefully set to properly scaled flight conditions. Data presented indicate a high degree of similarity between model and flight test results. It was found that the pressure time history waveforms are very much alike in shape and amplitude. Blade slap when it occurred seemed to be generated in about the same location in the rotor disk as on the flight vehicle. If model and tunnel conditions were properly matched, including inflow turbulence characteristics, the intensity of the blade-slap impulse seemed to correlate well with flight.

78N32816*# ISSUE 23 PAGE 3136 CATEGORY 71
RPT#: NASA-CP-2052-PT-1 L-12389 78/08/00 399 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Helicopter Acoustics
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A17/MF A01
Presented at the Intern. Specialists Symp., Hampton, Va., 22-24 May 1978; sponsored by the Am. Helicopter Soc. and AROD
MAJS: /*AEROACOUSTICS/*AIRCRAFT NOISE/*CONFERENCES/*HELICOPTERS
MINS: / AIR TRANSPORTATION/ AIRFOIL PROFILES/ HELIPORTS/ NOISE POLLUTION/ NOISE REDUCTION/ POLLUTION CONTROL/ PREDICTION ANALYSIS TECHNIQUES/ REGULATIONS/ ROTARY WINGS/ ROTOR AERODYNAMICS/ URBAN DEVELOPMENT/ WIND TUNNEL TESTS
ANN: Exterior and interior noise problems are addressed both from the physics and engineering as well as the human factors point of view. The role of technology in closing the gap between what the customers and regulating agencies would like to have and what is available is explored. Noise regulation concepts, design, operations and testing for noise control, helicopter noise prediction, and research tools and measurements are among the topics covered. For individual titles, see N78-32817 through N78-32835.

78N32049*# ISSUE 23 PAGE 3033 CATEGORY 2 RPT#: NASA-TM-74033 78/08/00 65 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aerodynamic characteristics of a 1/4 scale powered helicopter model with a V-type empennage conducted in the Langley V/STOL wind tunnel
AUTH: A/FREEMAN, C. E.; B/PHELPS, A. E., III; C/MINECK, R. E.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*AERODYNAMIC CHARACTERISTICS/*HELICOPTER WAKES/*SCALE MODELS/*WIND TUNNEL TESTS
MINS: / AERODYNAMIC STABILITY/ GROUND EFFECT (AERODYNAMICS)/ STRAIN GAGES/ V/STOL AIRCRAFT
ABA: Author
ABS: An investigation was made in the Langley V/STOL tunnel to determine rotor induced effects on a 1/4-scale helicopter model with a conventional empennage and also a V-type empennage with dihedral angles of 45 deg, 50 deg, 55 deg, and 60 deg. Static longitudinal and lateral directional stability data are presented for rotor advance ratios of 0.057, 0.102, and 0.192 in level flight and climb attitudes. The data are presented without analysis or discussion.

78N31792*# ISSUE 22 PAGE 2994 CATEGORY 61
RPT#: NASA-TM-78670 L-12046 CNT#: DA PROJ. 1L1-61102-AH-45 78/08/00 88 PAGES UNCLASSIFIED DOCUMENT

UTTL: An improved computational procedure for determining helicopter rotor blade natural modes

AUTH: A/WELLER, W. H.; B/MINECK, R. E. PAA: A/(Army Aviation Res. and Develop. Command, St. Louis, Mo.); B/(Army Aviation Res. and Develop. Command, St. Louis, Mo.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*COMPUTER PROGRAMS/*HELICOPTER PROPELLER DRIVE/* RESONANT FREQUENCIES/*ROTOR BLADES
MINS: / AERODYNAMIC CONFIGURATIONS/ HUBS/ ROTARY WINGS/ VIBRATION MODE
ABA: G.G.
ABS: An existing computer program, used for predicting the natural frequencies and mode shapes of helicopter rotor blades, was refined to improve program accuracy and versatility. The program is based on the Holzer-Myklestad approach adapted for rotating beams. Coupled vertical (out-of-plane), horizontal (in-plane), and torsional mode characteristics were determined for a variety of hub and blade configurations. The resulting program is documented by presenting the recursion equations and techniques for determining natural frequencies and mode shapes, input data requirements, and descriptions of various program outputs. The accuracy of the program is demonstrated by comparing computed results with exact solutions to classical problems and experimental data.

78N31044*# ISSUE 22 PAGE 2689 CATEGORY 2 RPT#: NASA-TM-78729 AVRADCOM-TR-78-34 L-12277 CNT#: DA PROJ. 1L1-61102-AH-45 78/08/00 22 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analysis of stability contributions of high dihedral V-tails
AUTH: A/FREEMAN, C. E.; B/YEAGER, W. T., JR. PAA: A/(AVRADCOM Res. and Technol. Labs.); B/(AVRADCOM Res. and Technol. Labs.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01
MAJS: /*AERODYNAMIC CHARACTERISTICS/*LATERAL STABILITY/* STATIC STABILITY/*WIND TUNNEL MODELS
MINS: / ANGLE OF ATTACK/ ROTARY WING AIRCRAFT/ THREE DIMENSIONAL FLOW/ WIND TUNNEL TESTS
ABA: B.B.
ABS: An investigation was undertaken to determine the effectiveness of four analytical methods (empirical, modified empirical, vortex-lattice, and an inviscid, three dimensional, potential flow, wing body program) to estimate the lateral and longitudinal static stability characteristics of an isolated V-tail wind tunnel model. The experimental tests were conducted in the V/STOL tunnel at a Mach number of 0.18. Angle-of-attack data were obtained from -12 deg to 8 deg at 0 deg sideslip. Sideslip sweeps from -5 deg to 10 deg were made at angles of attack of 4 deg, 0 deg and -4 deg. The V-tail dihedral angles were 45 deg, 50 deg, 55 deg, and 60 deg.

78N28680*# ISSUE 19 PAGE 2567 CATEGORY 45 RPT#: NASA-TM-78758 78/07/00 88 PAGES UNCLASSIFIED DOCUMENT
UTTL: A subjective field study of helicopter blade-slap noise
AUTH: A/POWELL, C. A.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01
Sponsored in part by FAA
MAJS: /*AIRCRAFT NOISE/*EFFECTIVE PERCEIVED NOISE LEVELS/* HELICOPTERS/*ROTARY WINGS
MINS: / HUMAN TOLERANCES/ NOISE INTENSITY/ NOISE MEASUREMENT / PREDICTION ANALYSIS TECHNIQUES
ABA: G.G.
ABS: The effects of impulsiveness on the noisiness of helicopters are examined by varying the main rotor speed while maintaining a constant airspeed. This resulted in other characteristics of the noise being held relatively constant. Other controlled variables included altitude, side line distance, descent operations, and level flyovers. A description is provided of the concept, experimental design and procedures along with results based on partial analyses of acoustic and subjective response data. No significant improvement in the noisiness predictive ability of EPNL was provided by either proposed or an A-weighted crest factor correction for impulsiveness.

78N28056*# ISSUE 19 PAGE 2481 CATEGORY 2 RPT#: NASA-TP-1213 AVRADCOM-TR-78-24 L-12159 78/07/00 23 PAGES UNCLASSIFIED DOCUMENT
UTTL: An analysis of the gust-induced overspeed trends of helicopter rotors
AUTH: A/JENKINS, J. L., JR.; B/YEAGER, W. T., JR. PAA: B/(AVRADCOM Res. and Technol. Labs.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01
MAJS: /*GUST LOADS/*HELICOPTERS/*HIGH SPEED/*ROTARY WINGS
MINS: / AERODYNAMICS/ ANGULAR ACCELERATION/ ROTOR LIFT/ ROTOR SPEED/ TIP SPEED
ABA: G.G.
ABS: Equations for analyzing the potential gust-induced overspeed tendency of helicopter rotors are presented. A parametric analysis was also carried out to

illustrate the sensitivity of rotor angular acceleration to changes in rotor lift, propulsive force, tip speed, and forward velocity.

78N27084*# ISSUE 18 PAGE 2348 CATEGORY 2 RPT#: NASA-TM-78705 78/05/00 85 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aerodynamic characteristics of a counter-rotating, coaxial, hingeless rotor helicopter model with auxiliary propulsion

AUTH: A/PHELPS, A. E., III; B/MINECK, R. E.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*AERODYNAMIC CHARACTERISTICS/*AUXILIARY PROPULSION/* HELICOPTERS/*WIND TUNNEL STABILITY TESTS

MINS: / JET PROPULSION/ RIGID ROTORS/ THRUST AUGMENTATION/ WIND TUNNEL MODELS

ABA: G.G.

ABS: A wind-tunnel model test at advance ratios from 0 to 0.3 with and without auxiliary jet engine thrust is reported. At each advance ratio and engine thrust, both the control power and the aircraft stability were measured. The results indicate that there is a cross-coupling for collective pitch and longitudinal cyclic pitch inputs. The control power for these inputs increased with advance ratio. There was also cross-coupling for differential collective pitch inputs. The airframe was longitudinally unstable, but the instability was less at the highest advance ratio tested. The airframe showed both positive effective dihedral and positive directional stability.

78N24515* ISSUE 15 PAGE 1996 CATEGORY 35 RPT#: NASA-CASE-LAR-11201-1 US-PATENT-4,082,001 US-PATENT-APPL-SN-788705 US-PATENT-CLASS-73-756 US-PATENT-CLASS-73-456 US-PATENT-CLASS-416-61 US-PATENT-CLASS-416-144 78/04/04 8 PAGES UNCLASSIFIED DOCUMENT
Filed 19 Apr. 1977 Supersedes N77-22452 (15 - 13, p 1725)

UTTL: Non-destructive method for applying and removing instrumentation on helicopter rotor blades TLSP: Patent

AUTH: A/LONG, W. C.; B/WILLIAMS, M. L. PAT: B/inventors (to NASA)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. SAP: Avail: US Patent Office

MAJS: /*HELICOPTERS/*NONDESTRUCTIVE TESTS/*ROTOR BLADES

MINS: / AIRFOILS/ PATENTS/ PRESSURE DISTRIBUTION/ ROTARY WING AIRCRAFT

ABA: Official Gazette of the U.S. Patent Office

ABS: A nondestructive method of applying and removing instrumentation on airfoils.

78N20128*# ISSUE 11 PAGE 1396 CATEGORY 6 RPT#: NASA-TP-1146 L-11956 78/04/00 49 PAGES UNCLASSIFIED DOCUMENT

UTTL: A rotor-mounted digital instrumentation system for helicopter blade flight research measurements

AUTH: A/KNIGHT, J. H., JR.; B/HAYWOOD, W. S., JR.; C/WILLIAMS, M. L.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*DIGITAL SYSTEMS/*FLIGHT INSTRUMENTS/*FLIGHT TESTS/* PRESSURE SENSORS/*ROTARY WINGS

MINS: / AIRFOILS/ DATA TRANSMISSION/ FREQUENCY DIVISION MULTIPLEXING/ HELICOPTERS/ PULSE CODE MODULATION

ABA: Author

ABS: A rotor mounted flight instrumentation system developed for helicopter rotor blade research is described. The system utilizes high speed digital techniques to acquire research data from miniature pressure transducers on advanced rotor airfoils which are flight tested on an AH-1G helicopter. The system employs microelectronic pulse code modulation (PCM) multiplexer digitizer stations located remotely on the blade and in a hub mounted metal canister. As many as 25 sensors can be remotely digitized by a 2.5 mm thick electronics package mounted on the blade near the tip to reduce blade wiring. The electronics contained in the canister digitizes up to 16 sensors, formats these data with serial PCM data from the remote stations, and transmits the data from the canister which is above the plane of the rotor. Data are transmitted over an RF link to the ground for real time monitoring and to the helicopter fuselage for tape recording. The complete system is powered by batteries located in the canister and requires no slip rings on the rotor shaft.

78N19144*# ISSUE 10 PAGE 1260 CATEGORY 5 78/01/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: The rotor systems research aircraft: A new step in the technology and rotor system verification cycle

AUTH: A/HOUSTON, R. J.; B/JENKINS, J. T., JR.; C/SHIPLEY, J. L. PAA. C/(Army Air Mobility Res. and Develop. Lab., Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A15/MF A01

In AGARD Rotorcraft Design 24 p (SEE N78-19126

10-05)
MAJS: /*FLIGHT TESTS/*RESEARCH VEHICLES/*ROTARY WING AIRCRAFT
MINS: / AIRFRAMES/ CALIBRATING/ DATA ACQUISITION/ ESCAPE SYSTEMS/ PYROTECHNICS
ABA: Author
ABS: Rotor systems research aircraft vehicles. (RSRA), were developed specifically to provide the capabilities necessary for the effective and efficient in-flight test and verification of promising new rotor concepts and supporting technology developments. The capabilities of the RSRA aircraft for potential research programs are discussed.

79A18138* ISSUE 5 PAGE 752 CATEGORY 5 RPT#: AHS 78-12 78/00/00 11 PAGE UNCLASSIFIED DOCUMENT
UTTL: Rotor Systems Research Aircraft /RSRA/ Emergency Escape System
AUTH: A/BEMENT, L. J. PAA: A/(NASA. Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: American Helicopter Society, Annual National Forum, 34th, Washington, D.C., May 15-17, 1978, Proceedings. (A79-18126 05-01) Washington, D.C., American Helicopter Society, 1978. 11 p.
Army-NASA-sponsored research.
MAJS: /*AIRCRAFT DESIGN/*ESCAPE SYSTEMS/*HELICOPTER DESIGN/*ROTOR SYSTEMS RESEARCH AIRCRAFT
MINS: / AIRCRAFT CONFIGURATIONS/ DELAY LINES/ EJECTION SEATS / MECHANICAL ENGINEERING/ PERFORMANCE TESTS/ PYROTECHNICS/ ROTARY WINGS
ABA: (Author)
ABS: The three-man Rotor Systems Research Aircraft (RSRA) Emergency Escape System, the first system known to be fully qualified and operational in a rotary wing aircraft, will have two modes of operation: one providing for full in-flight egress, and the other for the severance of the rotor blades for a return to base as a fixed-wing aircraft. This paper describes the escape system's design principles, integration into the aircraft, qualification, and performance.

79A18132*# ISSUE 5 PAGE 745 CATEGORY 2 RPT#: AHS 78-05 78/00/00 13 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotor-airfoil flight investigation - Preliminary results
AUTH: A/MORRIS, C. E. K., JR. PAA: A/(NASA. Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: American Helicopter Society, Annual National Forum, 34th, Washington, D.C., May 15-17, 1978, Proceedings. (A79-18126 05-01) Washington, D.C., American Helicopter Society, 1978. 13 p.
MAJS: /*AIRFOIL PROFILES/*FLIGHT TESTS/*HELICOPTER PERFORMANCE/*ROTARY WINGS
MINS: / AIRCRAFT MANEUVERS/ DATA ACQUISITION/ PRESSURE MEASUREMENT/ ROTOR AERODYNAMICS/ THREE DIMENSIONAL FLOW/ UNSTEADY FLOW/ WING LOADING
ABA: (Author)
ABS: A flight investigation has been conducted to study the behavior of three advanced-technology airfoils in the three-dimensional, unsteady-flow environment of the helicopter main rotor. Three sets of instrumented main-rotor blades were flown on an AH-1G helicopter. Each set employed one of three airfoils developed with significantly different design technologies. Data are given on performance, rotor loads, and the measurements of chordwise pressure distribution at 90 percent blade radius. The pressure data are compared with theoretical distributions calculated for two-dimensional, steady flow.

79A17583* ISSUE 5 PAGE 755 CATEGORY 6 78/00/00 9 PAGES UNCLASSIFIED DOCUMENT
UTTL: A new approach to helicopter rotor blade research instrumentation
AUTH: A/KNIGHT, V. H., JR. PAA: A/(NASA. Langley Research Center, Flight Electronics Div., Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: International Instrumentation Symposium, 24th, Albuquerque, N. Mex., May 1-5, 1978. Proceedings. Part 1. (A79-17576 05-35) Pittsburgh, Pa., Instrument Society of America, 1978. p. 103-111.
MAJS: /*DATA ACQUISITION/*FLIGHT TESTS/*HELICOPTER DESIGN/*IN-FLIGHT MONITORING/*ROTARY WINGS/*ROTOR BLADES
MINS: / AIRFOIL PROFILES/ DATA TRANSMISSION/ DIGITAL TECHNIQUES/ MULTIPLEXING/ PRESSURE SENSORS/ PROPELLER BLADES/ PULSE CODE MODULATION/ REAL TIME OPERATION
ABA: B.J.
ABS: A rotor-blade-mounted telemetry instrumentation system developed and used in flight tests by the NASA/Langley Research Center is described. The system uses high-speed digital techniques to acquire research data from miniature pressure transducers on advanced rotor airfoils which are flight tested using an AH-1G helicopter. The system employs microelectronic PCM multiplexer-digitizer stations located remotely on the blade and in a hub-mounted metal canister. The electronics contained in the canister digitizes up to 16 sensors, formats this data with serial PCM data from the remote stations, and transmits the data from the canister which is above the plane of the rotor.

Data is transmitted over an RF link to the ground for real-time monitoring and to the helicopter fuselage for tape recording.

80N15031*# ISSUE 6 PAGE 689 CATEGORY 2 RPT#: NASA-TM-78627 L-11608 CNT#: DA PROJ. 1L1-61102-AH-45 77/12/00 57 PAGES UNCLASSIFIED DOCUMENT

UTTL: Computer program to prepare airfoil characteristic data for use in helicopter performance calculations

AUTH: A/JONES, H. E.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*AIRFOILS/*COMPUTER PROGRAMS/*HELICOPTER PERFORMANCE

MINS: / FLIGHT SIMULATION/ MATHEMATICAL MODELS/ PERFORMANCE PREDICTION/ ROTOR AERODYNAMICS/ WIND TUNNEL TESTS

ABA: A.W.H.

ABS: A computer program developed to prepare wind tunnel generated airfoil data for input into helicopter performance prediction programs is described. The program provides for numerically cross plotting the data, plotting the data, and tabulating and punching the tabulated result into computer cards for use in the rotorcraft flight simulation model.

78N13041*# ISSUE 4 PAGE 427 CATEGORY 5 RPT#: NASA-TM-78629 77/11/00 208 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotor systems research aircraft simulation mathematical model

AUTH: A/HOUCK, J. A.; B/MOORE, F. L.; C/HOWLETT, J. J.; D/POLLOCK, K. S.; E/BROWNE, M. M. PAA: C/(Sikorsky Aircraft)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A10/MF A01

MAJS: /*AERONAUTICAL ENGINEERING/*COMPUTERIZED SIMULATION/* MATHEMATICAL MODELS/*RESEARCH AIRCRAFT/*ROTARY WING AIRCRAFT

MINS: / AERODYNAMIC CHARACTERISTICS/ HELICOPTER DESIGN/ MANEUVERABILITY/ PERFORMANCE PREDICTION/ ROTARY WINGS

ABA: Author

ABS: An analytical model developed for evaluating and verifying advanced rotor concepts is discussed. The model was used during in both open loop and real time man-in-the-loop simulation during the rotor systems research aircraft design. Future applications include: pilot training, preflight of test programs, and the evaluation of promising concepts before their implementation on the flight vehicle.

78N11053*# ISSUE 2 PAGE 150 CATEGORY 5 RPT#: NASA-TP-1046 L-11749 CNT#: DA PROJ. 1L2-62209-AH-76 77/11/00 76 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind-tunnel tests of wide-chord teetering rotors with and without outboard flapping hinges

AUTH: A/WELLER, W. H.; B/LEE, B. L. PAA: A/(Army Aviat. Res. and Develop. Command, St. Louis, Mo.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01
Washington

MAJS: /*ROTARY WINGS/*ROTOR AERODYNAMICS/*TEETERING/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC CHARACTERISTICS/ DYNAMIC RESPONSE/ FLAPPING HINGES/ HELICOPTERS

ABA: Author

ABS: Wind tunnel tests of aeroelastically designed helicopter rotor models were conducted to obtain rotor aerodynamic performance and dynamic response data pertaining to two-bladed teetering rotors with a wider chord and lower hover tip speed than currently employed on production helicopters. The effects of a flapping hinge at 82 percent radius were also studied. Finally, the effects of changing tip mass on operating characteristics of the rotor with the outboard flapping hinge were examined. The models were tested at several shaft angles of attack for five advance ratios, 0.15, 0.25, 0.35, 0.40, and 0.45. For each combination of shaft angle and advance ratio, the rotor lift was varied over a wide range to include simulated maneuver conditions. At each test condition, rotor aerodynamic performance and dynamic response data were obtained. From these tests, it was found that wide-chord rotors may be subject to large control forces. An outboard flapping hinge may be used to reduce beamwise bending moments over a significant part of the blade radius without significantly affecting the chordwise bending moments.

77A51094*# ISSUE 24 PAGE 4230 CATEGORY 71 RPT#: AIAA PAPER 77-1341 77/10/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Some measured and calculated effects of a tip vortex modification device on impulsive noise --- for helicopter rotors

AUTH: A/PEGG, R. J.; B/WHITE, R. P., JR. PAA: A/(NASA, Langley Research Center, Hampton, Va.); B/(Systems Research Laboratories, Inc., Newport News, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Systems Research Labs., Inc., Newport News, Va.
American Institute of Aeronautics and Astronautics. Aeroacoustics Conference, 4th, Atlanta, Ga., Oct. 3-5.

1977. 8 p.

MAJS: /*AIRCRAFT NOISE/*NOISE GENERATORS/*NOISE MEASUREMENT /*ROTARY WINGS/*WING TIP VORTICES

MINS: / FLOW VISUALIZATION/ HELICOPTERS/ NOISE REDUCTION/ NOISE SPECTRA/ SYSTEM EFFECTIVENESS/ WIND TUNNEL TESTS

ABA: M.L.

ABS: The results of a recent wind tunnel test program to evaluate the effectiveness of the Tip Air Mass Injection (TAMI) system in modifying the blade tip vortex occurring during helicopter flight is described with attention to the effect of this modification on the impulsive noise. The measurement program is explained, and the correlation between experimental and predicted results is discussed. Topics considered include the effect of descent rate on noise pressure time histories, the effect of air mass injection on noise, and the analysis based on a dB(A) weighted approach. Impulsive noise generated by the interaction of a helicopter rotor blade and the concentrated tip vortex during forward flight descent is a primary contributor to acoustic annoyance as it draws early attention to the presence of the helicopter.

77A51093*# ISSUE 24 PAGE 4103 CATEGORY 5 RPT#: AIAA PAPER 77-1340 77/10/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Some results of the testing of a full-scale Ogee tip helicopter rotor: acoustics, loads, and performance

AUTH: A/MANTAY, W. R.; B/SHIDLER, P. A.; C/CAMPBELL, R. L.
PAA: A/(U.S. Army, Air Mobility Research and Development Laboratory, Hampton, Va.); C/(NASA, Langley Research Center, Hampton, Va.)

CORP: Army Air Mobility Research and Development Lab., Hampton, Va.; National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga., Oct. 3-5, 1977. 10 p.

MAJS: /*AEROACOUSTICS/*FULL SCALE TESTS/*HELICOPTER PERFORMANCE/*OGEE SHAPE/*ROTOR AERODYNAMICS/*TIP SPEED

MINS: / AERODYNAMIC LOADS/ ROTARY WINGS/ UH-1 HELICOPTER

ABA: (Author)

ABS: Full-scale tests were utilized to investigate the effect of the Ogee tip on helicopter rotor acoustics, performance, and loads. Two facilities were used for this study: the Langley whirl tower and a UH-1H helicopter. The test matrix for hover on the whirl tower involved thrust values from 0 to 44,480 N (10,000 lbs) at several tip Mach numbers for both standard and Ogee rotors. The full-scale testing on the UH-1H encompassed the major portion of the flight envelope for that aircraft. Both near-field acoustic measurements as well as far-field flyover data were obtained for both the Ogee and standard rotors. Data analysis of the whirl-tower test shows that the Ogee tip does significantly diffuse the tip vortex while providing some improvement in hover performance. Flight testing of both rotors indicates that the strong impulsive noise signature of the standard rotor can be reduced with the Ogee rotor. Forward flight performance was significantly improved with the Ogee configuration for a large number of flight conditions. Further, rotor control loads and vibrations were reduced through use of this advanced tip rotor.

BCN70089* CATEGORY 5 77/09/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Vibration investigation of a large transport helicopter

AUTH: A/SNYDER, W. J.; B/CROSS, J. L.; C/SCHOULTZ, M. B.
PAA: C/(Va. Univ., Charlottesville)

CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. AVAIL.NTIS
In Shock and Vibration Inform. Center The Shock and Vibration Bull. Part 3 Sept. 1977 p 139-147 (SEE N80-70076 01-31)

MAJS: /*FLIGHT TESTS/*HELICOPTERS/*TRANSPORT AIRCRAFT/* VIBRATION MEASUREMENT/ VIBRATION TESTS

MINS: / HARMONIC ANALYSIS/ HELICOPTER DESIGN/ HELICOPTER PERFORMANCE/ ROTARY WINGS/ VIBRATION

77N32083*# ISSUE 23 PAGE 3024 CATEGORY 2 RPT#: NASA-TM-X-3548 L-11515 CNT#: DA PROJ. 1L1-61102-AH-45 77/09/00 120 PAGES UNCLASSIFIED DOCUMENT

UTTL: Effect of rotor wake on aerodynamic characteristics of a 1/6 scale model of the rotor systems research aircraft --- in the Langley V/STOL tunnel

AUTH: A/MINECK, R. E. PAA: A/(US Army Air Mobility R and D Lab., Langley, Va.)

CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A06/MF A01
Washington

MAJS: /*AERODYNAMIC CHARACTERISTICS/*COMPOUND HELICOPTERS/* HELICOPTER WAKES/*RESEARCH AIRCRAFT/*ROTOR AERODYNAMICS/*SCALE MODELS/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC COEFFICIENTS/ AIRCRAFT CONFIGURATIONS/ AIRCRAFT STABILITY/ ANGLE OF ATTACK/ ROTARY WINGS

ABA: Author

ABS: Tests were conducted in the Langley V/STOL tunnel to determine the effect of the main-rotor wake on the aerodynamic characteristics of the rotor systems research aircraft. A 1/6-scale model with a 4-blade articulated rotor was used to determine the effect of

the rotor wake for the compound configuration. Data were obtained over a range of angles of attack, angles of sideslip, auxiliary engine thrusts, rotor collective pitch angles, and rotor tip-path plane angles for several main-rotor advance ratios. Separate results are presented for the forces and moments on the airframe, the wing, and the tail. An analysis of the test data indicates significant changes in the aerodynamic characteristics. The rotor wake increases the longitudinal static stability, the effective dihedral, and the lateral static stability of the airframe. The rotor induces a downwash on the wing. This downwash decreases the wing lift and increases the drag. The asymmetrical rotor wake induces a differential lift across the wing and a subsequent rolling moment. These rotor induced effects on the wing become smaller with increasing forward speed.

78N15002*# ISSUE 6 PAGE 698 CATEGORY 2 RPT#: NASA-TM-74059 77/08/00 112 PAGES UNCLASSIFIED DOCUMENT

UTTL: Nonlinear aeroelastic equations for combined flapwise bending, chordwise bending, torsion, and extension of twisted nonuniform rotor blades in forward flight

AUTH: A/KAZA, K. R. V.; B/KVATERNIK, R. G. PAA: A/(NASA. Lewis Res. Center)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A06/MF A01

MAJS: /*AEROELASTICITY/*ELASTIC BENDING/*ROTARY WINGS/* TORSION/*TWISTED WINGS

MINS: / AERODYNAMIC LOADS/ HELICOPTERS/ NONLINEAR EQUATIONS

ABA: Author

ABS: The second-degree nonlinear aeroelastic equations for a flexible, twisted, nonuniform rotor blade which is undergoing combined flapwise bending, chordwise bending, torsion, and extension in forward flight are developed using Hamilton's principle. The equations have their basis in the geometric nonlinear theory of elasticity and are consistent with the small deformation approximation in which the elongations and sheears are negligible compared to unity, and the square of the derivative of the extensional deformation of the elastic axis is negligible compared to the squares of the bending slopes. No assumption is made regarding the coincidence of the elastic, mass, and tension axes of the blade, although the elastic and aerodynamic center axes are assumed coincident at the blade quarter chord. The blade aerodynamic loading is obtained from strip theory based on a quasi-steady approximation of two-dimensional, incompressible unsteady airfoil theory. The resulting equations are compared with several of those existing in the literature. These comparisons indicate several discrepancies with the present equations, particularly in the nonlinear terms. The reasons for these discrepancies are explained.

77N28911*# ISSUE 19 PAGE 2596 CATEGORY 71 RPT#: NASA-TN-D-8477 L-11349 77/07/00 43 PAGES UNCLASSIFIED DOCUMENT

UTTL: Interior noise reduction in a large civil helicopter

AUTH: A/HOWLETT, J. T.; B/CLEVENSON, S. A.; C/RYPF, J. A.; D/SNYDER, W. J. PAA: C/(Joint Inst. for Advan. of Flight Sci., Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*AIRCRAFT COMPARTMENTS/*HELICOPTERS/*NOISE REDUCTION

MINS: / ACOUSTIC PROPERTIES/ AIRCRAFT NOISE

ABA: Author

ABS: The results of an evaluation of the effectiveness of current noise reduction technology in attaining acceptable levels of interior noise in a large (about 20,000 kg) passenger-carrying helicopter are presented. The helicopter studied is a modified CH-53A with a specially designed, acoustically treated passenger cabin. The acoustic treatment reduced the average A-weighted interior noise levels from 115 db to 87 db. The study suggests selected improvements in the acoustic treatment which could result in additional reduction in cabin noise levels. The resulting levels would be only slightly greater than the interior noise levels of current narrow-body jet transports.

77N28112*# ISSUE 19 PAGE 2486 CATEGORY 5 RPT#: NASA-TN-D-8437 L-11315 CNT#: DA PROJ. 1L2-62209-AH-76 77/07/00 70 PAGES UNCLASSIFIED DOCUMENT

UTTL: Load and stability measurements on a soft-inplane rotor system incorporating elastomeric lead-lag dampers

AUTH: A/WELLER, W. H.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Hampton, Va. AVAIL.NTIS SAP: HC A04/MF A01 Washington Prepared in cooperation with the US Army Air Mobility R and D Lab., Hampton, Va.

MAJS: /*DYNAMIC RESPONSE/*HELICOPTERS/*ROTORS

MINS: / DAMPERS/ ELASTOMERS/ FLIGHT TESTS/ HOVERING

ABA: Author

ABS: An experimental investigation was conducted of the dynamic response and inplane stability associated with

a new soft-inplane helicopter rotor. The unique feature of this rotor was the use of an internal elastomeric damper to restrain the blade inplane motion about the lead-lag hinge. The properties of the elastomer were selected to provide both a nominal first inplane frequency ratio of 0.65 and sufficient damping to eliminate the need for additional external damping sources to prevent ground resonance on a typical fuselage structure. For this investigation a 1/5-scale aeroelastic model was used to represent the rotor. The four-blade model had a diameter of 3.05 m (10 ft) and a solidity of 0.103. The first out-of-plane frequency ratio was 1.06. The model was tested in hover and in forward flight up to an advance ratio of 0.45. At each forward speed the rotor lift was varied up to simulated maneuver conditions. The measured rotor loads and response were within acceptable limits, and no adverse response qualities were observed. Moderate out-of-plane hub moments were measured, even for zero lift, to indicate the beneficial control power available for this design. Blade inplane stability testing indicated that the rotor system damping remained at moderate levels throughout the operating envelope.

77N28090*# ISSUE 19 PAGE 2483 CATEGORY 2 RPT#: NASA-TM-X-3489 L-11287 CNT#: DA PROJ. 1F1-61101-AH-45 77/06/00 240 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aerodynamic characteristics of a 1/6-scale powered model of the rotor systems research aircraft

AUTH: A/MINECK, R. E.; B/FREEMAN, C. E.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Moffett Field, Calif. AVAIL.NTIS SAP: HC A11/MF A01
Washington Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.

MAJS: /*AERODYNAMIC CHARACTERISTICS/*RESEARCH AIRCRAFT/* ROTORS

MINS: / AIRFRAMES/ HELICOPTERS/ WIND TUNNEL TESTS

ABA: Author

ABS: A wind-tunnel investigation was conducted to determine the effects of the main-rotor wake on the aerodynamic characteristics of the rotor systems research aircraft (RSRA). For the investigation, a 1/6-scale model with a four-blade articulated main rotor was used. Tests were conducted with and without the main rotor. Both the helicopter and the compound helicopter were tested. The latter configuration included the auxiliary thrust engines and the variable-incidence wing. Data were obtained over ranges of angle of attack, angle of sideslip, and main-rotor collective pitch angle at several main-rotor advance ratios. Results are presented for the total loads on the airframe as well as the loads on the rotor, the wing, and the tail. The results indicated that without the effect of the rotor wake, the RSRA had static longitudinal and directional stability and positive effective dihedral. With the effect of the main rotor and its wake, the RSRA exhibited longitudinal instability but retained static directional stability and positive effective dihedral.

77N24059*# ISSUE 15 PAGE 1938 CATEGORY 2 RPT#: NASA-TM-X-71951 77/05/03 90 PAGES UNCLASSIFIED DOCUMENT

UTTL: Theoretical study of the effect of ground proximity on the induced efficiency of helicopter rotors

AUTH: A/HEYSON, H. H.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*GROUND EFFECT (AERODYNAMICS)/*HELICOPTER PERFORMANCE /*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / AERODYNAMIC DRAG/ HELICOPTER TAIL ROTORS/ HOVERING STABILITY/ UPWASH

ABA: Author

ABS: A study of rotors in forward flight within ground effect showed that the ground-induced interference is an upwash and a decrease in forward velocity. The interference velocities are large, oppose the normal flow through the rotor, and have large effects on the induced efficiency. Hovering with small ground clearances may result in significant blade stall. As speed is increased from hover in ground effect, power initially increases rather than decreases. At very low heights above the ground, the power requirements become nonlinear with speed as a result of the streamwise interference. The streamwise interference becomes greater as the wake approaches the ground and eventually distorts the wake to form the ground vortex which contributes to certain observed directional stability problems.

77N26082*# ISSUE 17 PAGE 2211 CATEGORY 2 RPT#: NASA-TN-D-8456 CNT#: DA PROJ. 1L1-61102-AH-45 77/05/00 141 PAGES UNCLASSIFIED DOCUMENT

UTTL: Airframe, wing, and tail aerodynamic characteristics of a 1/6-scale model of the rotor systems research aircraft with the rotors removed

AUTH: A/MINECK, R. E.; B/FREEMAN, C. E. PAA: A/(Army Air Mobility Res. and Develop. Lab., Hampton, Va.); B/(Army Air Mobility Res. and Develop. Lab., Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A07/MF A01
Washington
MAJS: /*AERODYNAMIC CHARACTERISTICS/*BODY-WING AND TAIL CONFIGURATIONS/*HELICOPTER PERFORMANCE/*RESEARCH AIRCRAFT
MINS: / ANGLE OF ATTACK/ HELICOPTER TAIL ROTORS/ SCALE MODELS/ WIND TUNNEL TESTS
ABA: Author
ABS: A wind-tunnel investigation was conducted to determine the aerodynamic characteristics of the rotor systems research aircraft (RSRA) as the helicopter and the compound helicopter with the rotors removed. Data were obtained over ranges of angle of attack and angle of sideslip. Results are presented for the total loads on the airframe as well as the loads on the wing and the tail. The results indicate that the RSRA with the rotors removed has stable static longitidinal and directional characteristics and has stable effective dihedral.

77N23098*# ISSUE 14 PAGE 1808 CATEGORY 5 RPT#: NASA-TM-D-8424 L-11275 77/05/00 33 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Empirical comparison of a fixed-base and a moving-base simulation of a helicopter engaged in visually conducted slalom runs
AUTH: A/PARRISH, R. V.; B/HOUCK, J. A.; C/MARTIN, D. J., JR. PAA: C/(Sperry Rand Corp., Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/HC A01
Washington
MAJS: /*FLIGHT SIMULATION/*HELICOPTER PERFORMANCE/*S-61 HELICOPTER/*VISUAL CONTROL
MINS: / CONTROL SIMULATION/ FLIGHT SIMULATORS/ LOW ALTITUDE/ TASK COMPLEXITY
ABA: Author
ABS: Combined visual, motion, and aural cues for a helicopter engaged in visually conducted slalom runs at low altitude were studied. The evaluation of the visual and aural cues was subjective, whereas the motion cues were evaluated both subjectively and objectively. Subjective and objective results coincided in the area of control activity. Generally, less control activity is present under motion conditions than under fixed-base conditions, a fact attributed subjectively to the feeling of realistic limitations of a machine (helicopter) given by the addition of motion cues. The objective data also revealed that the slalom runs were conducted at significantly higher altitudes under motion conditions than under fixed-base conditions.

77N23061*# ISSUE 14 PAGE 1805 CATEGORY 2 RPT#: NASA-TM-X-3501 L-11271 CNT#: DA PROJ. 1F1-61102-AH-45 77/05/00 41 PAGES UNCLASSIFIED DOCUMENT
UTTL: Tail contribution to the directional aerodynamic characteristics of a 1/6-scale model of the rotor systems research aircraft with a tail rotor
AUTH: A/MINECK, R. E. PAA: A/(Army Air Mobility Res. and Develop. Lab., Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01
Washington
MAJS: /*AERODYNAMIC CHARACTERISTICS/*DIRECTIONAL STABILITY/*RESEARCH AIRCRAFT/*TAIL ROTORS
MINS: / HELICOPTER DESIGN/ ROTOR AERODYNAMICS/ THRUST/ WIND TUNNEL TESTS
ABA: Author
ABS: The results are presented of a wind tunnel investigation to determine the tail contribution to the directional aerodynamic characteristics of a 1/6-scale model of the rotor systems research aircraft (RSRA) with a tail rotor. No main rotor was used during the investigation. Data were obtained with and without the tail rotor over a range of sideslip angle and over a range of rotor collective pitch angle. The model with the tail rotor was tested at several advance ratios with and without thrust from the auxiliary thrust engines on the RSRA fuselage. Increasing the space between the tail-rotor hub and the vertical tail reduced the tail-rotor torque required at moderate to high rotor thrust. Increasing the exit dynamic pressure of the auxiliary thrust engines decreases the tail contribution to the static directional stability. The tail-rotor thrust and its interference provide a positive increment to the static directional stability. The tail contribution increases with forward speed. The adverse yawing moment of the airframe would strongly affect the thrust required of the tail rotor when the helicopter is hovering in a crosswind.

77N23573*# ISSUE 14 PAGE 1871 CATEGORY 43 RPT#: NASA-TM-X-74032 77/04/00 190 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Results from the National Aeronautics and Space Administration remote sensing experiments in the New York Bight, 7-17 April 1975
AUTH: A/HALL, J. B., JR.; B/PEARSON, A. O. PAT: A/comp.; B/comp.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A09/MF A01
MAJS: /*CONTAMINANTS/*IMAGERY/*NEW YORK/*REMOTE SENSORS/*SEA WATER
MINS: / ALGAE/ INFRARED SCANNERS/ SEDIMENT TRANSPORT/ THERMAL POLLUTION/ WATER COLOR
ABA: Author
ABS: A cooperative operation was conducted in the New York Bight to evaluate the role of remote sensing technology to monitor ocean dumping. Six NASA remote sensing experiments were flown on the C-54, U-2, and C-130 NASA aircraft, while NOAA obtained concurrent sea truth information using helicopters and surface platforms. The experiments included: (1) a Radiometer/Scatterometer (RADSCAT), (2) an Ocean Color Scanner (OCS), (3) a Multichannel Ocean Color Sensor (MOCS), (4) four Hasselblad cameras, (5) an Ebert spectrometer; and (6) a Reconafax IV infrared scanner and a Precision Radiation Thermometer (PRT-5). The results of these experiments relative to the use of remote sensors to detect, quantify, and determine the dispersion of pollutants dumped into the New York Bight are presented.

77N22098*# ISSUE 13 PAGE 1678 CATEGORY 5 RPT#: NASA-TM-X-3491 L-11200 77/04/00 43 PAGES UNCLASSIFIED DOCUMENT
UTTL: Computer simulation incorporating a helicopter model for evaluation of aircraft avionics systems
AUTH: A/OSTROFF, A. J.; B/WOOD, R. B.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01
Washington
MAJS: /*AVIONICS/*COMPUTERIZED SIMULATION/*HELICOPTER CONTROL/*MATHEMATICAL MODELS
MINS: / AIRCRAFT GUIDANCE/ CH-47 HELICOPTER/ COMPUTER PROGRAMS/ HELICOPTER DESIGN/ NAVIGATION AIDS
ABA: Author
ABS: A computer program was developed to integrate avionics research in navigation, guidance, controls, and displays with a realistic aircraft model. A user oriented program is described that allows a flexible combination of user supplied models to perform research in any avionics area. A preprocessor technique for selecting various models without significantly changing the memory storage is included. Also included are mathematical models for several avionics error models and for the CH-47 helicopter used in this program.

77N19008*# ISSUE 10 PAGE 1355 CATEGORY 2 RPT#: NASA-TM-X-3476 L-11273 CNT#: DA PROJ. 1L2-62209-AH-76 77/03/00 54 PAGES UNCLASSIFIED DOCUMENT
UTTL: Wind tunnel investigation of an unpowered helicopter fuselage model with a V-type empennage
AUTH: A/FREEMAN, C. E.; B/YEAGER, W. T., JR.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Hampton, Va.
AVAIL.NTIS SAP: HC A04/MF A01
Washington Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
MAJS: /*FUSELAGES/*HELICOPTERS/*STATIC STABILITY/*TAIL SURFACES
MINS: / BODY-WING AND TAIL CONFIGURATIONS/ STRUCTURAL DESIGN CRITERIA/ WIND TUNNEL MODELS/**ANGLE OF ATTACK/** CONTROL SURFACES/**DIMENSIONS/**LATERAL STABILITY/** LONGITUDINAL STABILITY/**PLANFORMS/**STATIC STABILITY
ABA: Author
ABS: The applicability of a V-type empennage on an unpowered semiscale helicopter fuselage is considered as design criteria for improved directional control devices. Configuration changes included variations of V-tail dihedral angle, planform area, and incidence angle. Of the configurations tested, a V-tail with a dihedral angle of 55 deg, a total planform area of 0.244 sq m, and an incidence angle of 5 deg most nearly match the trim and static stability of the baseline conventional empennage.
SUM: Design optimization of empennage configuration for helicopter stability and control at cruise speed; the variables include dimensions, angle of attack, longitudinal characteristics, planform, fuselage, and lateral directional characteristics; 10 figures and no tables.

77N18117*#** ISSUE 9 PAGE 1127 CATEGORY 3 RPT#: NASA-TM-X-74007 77/03/00 21 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter sling load accident/incident survey: 1968 - 1974
AUTH: A/SHAUGHNESSY, J. D.; B/PARDUE, M. D. PAA: B/(Old Dominion Univ.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01
MAJS: /*AIRCRAFT ACCIDENT INVESTIGATION/*HELICOPTER CONTROL /*MIDAIR COLLISIONS
MINS: / COLLISIONS/ HELICOPTER PERFORMANCE/ HUMAN FACTORS ENGINEERING/ PILOT ERROR
ABA: Author
ABS: During the period considered a mean of eleven

accidents per year occurred and a mean of eleven persons were killed or seriously injured per year. Forty-one percent of the accidents occurred during hover, and 63 percent of the accidents had pilot error listed as a cause/factor. Many accidents involved pilots losing control of the helicopter or allowing a collision with obstructions to occur. There was a mean of 58 incidents each year and 51 percent of these occurred during cruise.

77N17102*# ISSUE 8 PAGE 987 CATEGORY 8 RPT#: NASA-TM-D-8385 L-10982 77/02/00 43 PAGES UNCLASSIFIED DOCUMENT

UTTL: The effect of variations in controls and displays on helicopter instrument approach capability

AUTH: A/NIESSEN, F. R.; B/KELLY, J. R.; C/GARREN, J. F., JR.; D/YENNI, K. R.; E/PERSON, L. H., JR.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01
Washington

MAJS: /*APPROACH INDICATORS/*FLIGHT CONTROL/*HELICOPTER CONTROL/*INSTRUMENT APPROACH

MINS: / ATTITUDE STABILITY/ DECELERATION/ DISPLAY DEVICES/ HELICOPTER PERFORMANCE

ABA: Author

ABS: A flight investigation was conducted with a variable stability helicopter to determine the effects of variations in controls and displays on helicopter instrument approach capabilities. The baseline instrument approach task was a decelerating approach to a hover along a 6 deg glide slope. Pilot evaluations were obtained for both the constant speed part of the task and the deceleration and hover part of the task. The attitude stability augmentation system (SAS) was strongly preferred over the rate SAS because the aircraft had a divergent pitch response. From a display variation standpoint, it was not possible to decelerate to a hover in a consistent manner, regardless of the control system employed, with situation information only. In particular, the deceleration and hover part of the task was unacceptable without flight director command information.

77N17103*# ISSUE 8 PAGE 989 CATEGORY 8 RPT#: NASA-TM-X-74004 77/01/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of a modified complementary filtering technique for increased aircraft control system frequency bandwidth in high vibration environment

AUTH: A/GARREN, J. F., JR.; B/NIESSEN, F. R.; C/ABBOTT, T. S.; D/YENNI, K. R.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*AIRCRAFT CONTROL/*BANDPASS FILTERS/*BANDWIDTH/*VIBRATION EFFECTS

MINS: / AERODYNAMIC STABILITY/ FILTRATION/ HELICOPTER CONTROL/ HIGH GAIN/ NOISE INTENSITY/ ROLL

ABA: Author

ABS: A modified complementary filtering technique for estimating aircraft roll rate was developed and flown in a research helicopter to determine whether higher gains could be achieved. Use of this technique did, in fact, permit a substantial increase in system frequency bandwidth because, in comparison with first-order filtering, it reduced both noise amplification and control limit-cycle tendencies.

77N14999*# ISSUE 6 PAGE 699 CATEGORY 2 RPT#: NASA-TM-X-73990 77/01/00 179 PAGES UNCLASSIFIED DOCUMENT

UTTL: Two-dimensional aerodynamic characteristics of several rotorcraft airfoils at Mach numbers from 0.35 to 0.90

AUTH: A/NOONAN, K. W.; B/BINGHAM, G. J. PAA: A/(Army Air Mobility Res. and Develop. Lab., Hampton, Va.); B/(Army Air Mobility Res. and Develop. Lab., Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A09/MF A01

MAJS: /*AERODYNAMIC CHARACTERISTICS/*AIRFOILS/*MACH NUMBER/*ROTORCRAFT AIRCRAFT/*TWO DIMENSIONAL FLOW

MINS: / AERODYNAMIC COEFFICIENTS/ LIFT/ THICKNESS RATIO/ TRANSONIC WIND TUNNELS/ WIND TUNNEL TESTS/**AIRFOIL PROFILES/**ORIFICES/**POSITION (LOCATION)

ABA: Author

ABS: An investigation was conducted in the Langley 6- by 28-inch transonic tunnel and the 6- by 19-inch transonic tunnel to determine the two-dimensional aerodynamic characteristics of several rotorcraft airfoils at Mach numbers from 0.35 to 0.90. The airfoils differed in thickness, thickness distribution, and camber. The FX69-H-098, the BHC-540, and the NACA 0012 airfoils were investigated in the 6- by 28-inch tunnel at Reynolds numbers (based on chord) from about 4.7 to 9.3 million at the lowest and highest test Mach numbers respectively. The FX69-H-098, the NLR-1, the BHC-540, and the NACA 23012 airfoils were investigated in the 6- by 19-inch tunnel at Reynolds numbers from about 0.9 to 2.2 million at the lowest and highest test Mach numbers respectively.

SUM: Design coordinates and static pressure orifice locations for 5 airfoil models given in percent

airfoil chord; variables include upper surface, lower surface, stations; 10 tables include numeric data.

78A35662* ISSUE 14 PAGE 2606 CATEGORY 71
77/00/00 16 PAGES UNCLASSIFIED DOCUMENT
UTTL: Observed variability of aircraft noise footprint measurements
AUTH: A/MAGLIERI, D. J.; B/HENDERSON, H. R., C/HILTON, D. A. PAA: C/(NASA, Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: NOISE-CON 77; Proceedings of the National Conference on Noise Control Engineering, Hampton, Va., October 17-19, 1977. (A78-35651 14-01) New York, Noise Control Foundation, 1977, p. 443-458.
MAJS: /*AIRCRAFT LANDING/*FOOTPRINTS/*GROUND EFFECT (AERODYNAMICS)/*HELICOPTERS/*JET AIRCRAFT NOISE/*NOISE MEASUREMENT/*TURBOJET ENGINES
MINS: / ATMOSPHERIC EFFECTS/ DATA RECORDING/ FIGHTER AIRCRAFT/ NASA PROGRAMS/ NOISE POLLUTION/ RADAR TRACKING/ REMOTE CONTROL/ TELEOPERATORS
ABA: G.R.
ABS: A description is presented of some measurements which illustrate the variability of the experimentally developed ground noise footprints for a series of landing approach operations of a turbojet aircraft and a turbine powered helicopter. Measurements on the recently developed NASA Remotely Operated Multiple Array Acoustic Range are considered. The information presented is related to a turbojet fighter aircraft and a turbine powered helicopter performing landing approach operations along a 3 deg approach path. Each vehicle was acquired on radar tracking approximately 10 kilometers from the touchdown point and entered the test area at an altitude of about 470 m. The measured variations in meteorological quantities for the two time periods during which these tests were conducted are presented in graphs. Other graphs show the ground noise contour for the turbojet aircraft and the turbine helicopter.

77A40059* ISSUE 18 PAGE 3002 CATEGORY 5 RPT#: AHS 77-33-15 77/00/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Efficient civil helicopters - The payoff of directed research
AUTH: A/WIESNER, W.; B/SNYDER, W. J. PAA: A/(Boeing Vertol Co., Philadelphia, Pa.); B/(NASA, Langley Research Center, Hampton, Va.)
CORP: Boeing Vertol Co., Philadelphia, Pa.; National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: American Helicopter Society, Annual National Forum, 33rd, Washington, D.C., May 9-11, 1977. Proceedings. (A77-40048 18-01) Washington, D.C., American Helicopter Society, Inc., 1977, 10 p.
MAJS: /*COST REDUCTION/*HELICOPTER DESIGN/*PASSENGER AIRCRAFT/*RESEARCH AND DEVELOPMENT
MINS: / AIRCRAFT MAINTENANCE/ CIVIL AVIATION/ ENERGY CONSUMPTION/ HELICOPTER PERFORMANCE
ABA: (Author)
ABS: Studies have been performed to identify the key areas and cost of research that will reduce the cost of operation of helicopters through reduction of energy consumption, increased performance, and reduction of maintenance. The basic analyses were made for a large passenger helicopter, with subsequent studies considering applicability to all sizes. These study results were then applied to the existing and projected U.S./Canada helicopter fleet to compare the cost of research to the dollars saved as a result of that research. These comparisons show that research costs to reduce energy and lower maintenance have payback periods of less than one year, either as higher return to the operator or as lower rental price to the customer.

77N16864*# ISSUE 7 PAGE 952 CATEGORY 71 RPT#: NASA-TN-D-8359 L-11137 76/12/00 55 PAGES UNCLASSIFIED DOCUMENT
UTTL: Subjective assessment of simulated helicopter blade-slap noise
AUTH: A/LAWTON, ... W.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A04/MF A01
Washington
MAJS: /*AERODYNAMIC NOISE/*HELICOPTERS/*HUMAN REACTIONS/*NOISE TOLERANCE
MINS: / ACOUSTIC SIMULATION/ HUMAN TOLERANCES/ PSYCHOACOUSTICS/ ROTARY WINGS/**AUDIO FREQUENCIES/** EFFECTIVE PERCEIVED NOISE LEVELS/**FREQUENCY RANGES/** HUMAN TOLERANCES/**NOISE INTENSITY/**PRESSURE DISTRIBUTION
ABA: Author
ABS: The effects of several characteristics of helicopter blade slap upon human annoyance are examined. Blade slap noise was simulated by using continuous and impulsive noises characterized by five parameters: The number of sine waves in a single impulse; the frequency of the sine waves; the impulse repetition frequency; the sound pressure level (SPL) of the continuous noise; and the idealized crest factor of the impulses. Ten second samples of noise were

synthesized with each of the five parameters at representative levels. The annoyance of each noise was judged by 40 human subjects. Analysis of the subjective data indicated that each of the five parameters had a statistically significant effect upon the annoyance judgments. The impulse crest factor and SPL of the continuous noise had very strong positive relationships with annoyance. The other parameters had smaller, but still significant, effects upon the annoyance judgments.

SUM: Psychoacoustic annoyance rating for impulsive noise characteristics; variables include number of sine waves, frequency of sine waves, impulse frequency, sound pressure level, and impulse peak ratios. 48 figures and 7 tables are included.

77N16376*# ISSUE 7 PAGE 893 CATEGORY 39 RPT#: NASA-TM-X-73997 76/12/00 37 PAGES UNCLASSIFIED DOCUMENT

UTTL: Nonlinear curvature expressions for combined flapwise bending, chordwise bending, torsion and extension of twisted rotor blades

AUTH: A/KVATERNIK, R. G.; B/KAZA, K. R. V. PAA: B/(George Washington Univ., Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*CURVATURE/*NONLINEAR EQUATIONS/*ROTOR BLADES (TURBOMACHINERY)/*TORSION

MINS: / AEROELASTICITY/ ELASTIC BENDING/ EXTENSIONS/ HELICOPTERS

ABA: Author

ABS: The nonlinear curvature expressions for a twisted rotor blade or a beam undergoing transverse bending in two planes, torsion, and extension were developed. The curvature expressions were obtained using simple geometric considerations. The expressions were first developed in a general manner using the geometrical nonlinear theory of elasticity. These general nonlinear expressions were then systematically reduced to four levels of approximation by imposing various simplifying assumptions, and in each of these levels the second degree nonlinear expressions were given. The assumptions were carefully stated and their implications with respect to the nonlinear theory of elasticity as applied to beams were pointed out. The transformation matrices between the deformed and undeformed blade-fixed coordinates, which were needed in the development of the curvature expressions, were also given for three of the levels of approximation. The present curvature expressions and transformation matrices were compared with corresponding expressions existing in the literature.

77N16021*# ISSUE 7 PAGE 843 CATEGORY 5 RPT#: NASA-TN-D-8378 L-11083 76/12/00 92 PAGES UNCLASSIFIED DOCUMENT

UTTL: Effects of rotor model degradation on the accuracy of rotorcraft real time simulation

AUTH: A/HOUCK, J. A.; B/BOWLES, R. L.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A05/MF A01 Washington

MAJS: /*COMPUTERIZED SIMULATION/*ROTARY WINGS/*ROTORCRAFT AIRCRAFT

MINS: / DYNAMIC RESPONSE/ HELICOPTERS/ MATHEMATICAL MODELS/ REAL TIME OPERATION

ABA: Author

ABS: The effects are studied of degrading a rotating blade element rotor mathematical model to meet various real-time simulation requirements of rotorcraft. Three methods of degradation were studied: reduction of number of blades, reduction of number of blade segments, and increasing the integration interval, which has the corresponding effect of increasing blade azimuthal advance angle. The three degradation methods were studied through static trim comparisons, total rotor force and moment comparisons, single blade force and moment comparisons over one complete revolution, and total vehicle dynamic response comparisons. Recommendations are made concerning model degradation which should serve as a guide for future users of this mathematical model, and in general, they are in order of minimum impact on model validity: (1) reduction of number of blade segments, (2) reduction of number of blades, and (3) increase of integration interval and azimuthal advance angle. Extreme limits are specified beyond which the rotating blade element rotor mathematical model should not be used.

77N12066*# ISSUE 3 PAGE 292 CATEGORY 8 RPT#: NASA-TN-D-8275 L-10841 CNT#: DA PROJ. 1F2-62209-AH-76 76/12/00 41 PAGES UNCLASSIFIED DOCUMENT

UTTL: A parametric analysis of visual approaches for helicopters

AUTH: A/MOEN, G. C.; B/DICARLO, D. J.; C/YENNI, K. R.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Hampton, Va. AVAIL.NTIS SAP: HC A03/MF A01 Washington Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.

MAJS: /*APPROACH CONTROL/*HELICOPTER CONTROL/*HELICOPTER PERFORMANCE/*INSTRUMENT APPROACH

MINS: / AIRPORTS/ BRAKES (FOR ARRESTING MOTION)/

MATHEMATICAL MODELS/, PITCH (INCLINATION)

ABA: Author

ABS: A flight investigation was conducted to determine the characteristic shapes of the altitude, ground speed, and deceleration profiles of visual approaches for helicopters. Two hundred thirty-six visual approaches were flown from nine sets of initial conditions with four types of helicopters. Mathematical relationships were developed that describe the characteristic visual deceleration profiles. These mathematical relationships were expanded to develop equations which define the corresponding nominal ground speed, pitch attitude, pitch rate, and pitch acceleration profiles. Results are applicable to improved helicopter handling qualities in terminal area operations.

76A45383*# ISSUE 23 PAGE 3571 CATEGORY 3 RPT#: AIAA PAPER 76-896 76/09/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Civil helicopter flight research --- for CH-53 helicopter

AUTH: A/SNYDER, W. J.; B/SCHOULTZ, M. B. PAA: A/(NASA, Langley Research Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
American Institute of Aeronautics and Astronautics, Aircraft Systems and Technology Meeting, Dallas, Tex., Sept. 27-29, 1976, 13 p.

MAJS: /*H-53 HELICOPTER/*HELICOPTER DESIGN/*PASSENGER AIRCRAFT/*RESEARCH AIRCRAFT

MINS: / AIRCRAFT NOISE/ CIVIL AVIATION/ NASA PROGRAMS/ OPERATIONAL PROBLEMS/ RESEARCH AND DEVELOPMENT/ RIDING QUALITY/ STRUCTURAL VIBRATION

ABA: S.N.

ABS: The paper presents a description of the NASA CH-53 Civil Helicopter Research Aircraft and discusses preliminary results of the aircraft flight research performed to evaluate factors and requirements for future helicopter transport operations. The CH-53 equipped with a 16-seat airline-type cabin and instrumented for flight research studies in noise, vibration, handling qualities, passenger acceptance, fuel utilization, terminal area maneuvers, and gust response. Predicted fuel usage for typical short-haul missions as compared with actual fuel use. Pilot ratings for an IFR handling quality task for three levels of stability augmentation are presented, and the effects of internal noise, vibration, and motion on passenger acceptance are discussed. Future planned CH-53 flight research within the Civil Helicopter Technology Program is discussed.

76N30199*# ISSUE 21 PAGE 2886 CATEGORY 5 RPT#: NASA-TM-X-73935 76/08/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of a helicopter mathematical model to the Langley differential maneuvering simulator for use in a helicopter/fighter evasive maneuver study

AUTH: A/HOUCK, J. A.; B/ASHWORTH, B. R.; C/BAKER, D. R. PAA: C/(Sperry Support Services, Sperry Rand Corp.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $3.50

MAJS: /*EVASIVE ACTIONS/*FLIGHT SIMULATORS/*H-53 HELICOPTER /*MATHEMATICAL MODELS

MINS: / FIGHTER AIRCRAFT/ FLIGHT TESTS/ HELICOPTER PERFORMANCE/ REAL TIME OPERATION

ABA: Author

ABS: A real time simulation study was conducted using a differential maneuvering simulator to determine and evaluate helicopter evasive maneuvers when attacked by fighter aircraft. A general helicopter mathematical model was modified to represent an H-53 helicopter. The helicopter model was compared to H-53 flight test data to determine any differences between the simulated and actual vehicles. The simulated helicopter was also subjectively validated by participating pilots. Two fighter mathematical models validated in previous studies were utilized for the attacking aircraft. The results of this simulation study have been verified in a flight test program conducted by the U. S. Air Force and were found to closely match the flight results.

76A38079*# ISSUE 18 PAGE 2874 CATEGORY 71 RPT#: AIAA PAPER 76-563 CNT#: NGR-09-010-085 76/07/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of a noncompact source theory with applications to helicopter rotors

AUTH: A/FARASSAT, F.; B/BROWN, T. J. PAA: B/(NASA, Langley Research Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
American Institute of Aeronautics and Astronautics, Aero-Acoustics Conference, 3rd, Palo Alto, Calif., July 20-23, 1976, 8 p.

MAJS: /*AERODYNAMIC NOISE/*AIRCRAFT NOISE/*ROTARY WINGS/*SOUND PRESSURE

MINS: / HELICOPTERS/ NOISE GENERATORS/ ROTOR AERODYNAMICS

ABA: C.K.D.

ABS: A new formulation for determining the acoustic field of moving bodies, based on acoustic analogy, is derived. The acoustic pressure is given as the sum of two integrals, one of which has a derivative with respect to time. The integrands are functions of the

normal velocity and surface pressure of the body. A computer program based on this formulation was used to calculate acoustic pressure signatures for several helicopter rotors from experimental surface pressure data. Results are compared with those from compact source calculations. It is shown that noncompactness of steady sources on the rotor can account for the high harmonics of the pressure system. Thickness noise is shown to be a significant source of sound, especially for blunt airfoils in regions where noncompact source theory should be applied.

76A38070*# ISSUE 18 PAGE 2873 CATEGORY 71
RPT#: AIAA PAPER 76-551 76/07/00 7 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Measurement, analysis, and prediction of aircraft interior noise

AUTH: A/HOWLETT, J. T.; B/WILLIAMS, L. H.; C/CATHERINES, J. J.; D/JHA, S. K. PAA: C/(NASA, Langley Research Center, Hampton, Va.); D/(Cranfield Institute of Technology, Cranfield, Beds., England)

CORP: Cranfield Inst. of Tech., Bedfordshire (England).; National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
American Institute of Aeronautics and Astronautics, Aero-Acoustics Conference, 3rd, Palo Alto, Calif., July 20-23, 1976, 7 p.

MAJS: /*AIRCRAFT NOISE/*NOISE MEASUREMENT/*NOISE REDUCTION/* PASSENGER AIRCRAFT/*PREDICTION ANALYSIS TECHNIQUES

MINS: / COMFORT/ FUSELAGES/ GROUND TESTS/ HELICOPTERS/ LIGHT AIRCRAFT/ STRUCTURAL VIBRATION

ABA: (Author)

ABS: Considerations of comfort of passengers and crew in light aircraft and helicopters indicate substantial benefits may be obtained by the reduction of interior noise levels. This paper discusses an ongoing research effort to reduce interior noise in such vehicles. Data from both field and laboratory studies for a light aircraft are presented. The laboratory data indicate that structural vibration is an efficient source of interior noise and should be considered in the reduction of interior noise. Flight data taken on a helicopter before and after installation of acoustic treatment demonstrate that over 30 dB of noise reduction can be obtained in certain portions of the spectra. However, subjective evaluations of the treated vehicle indicate that further reductions in interior noise are desirable. An existing interior noise prediction method which was developed for large jet transports was applied to study low-frequency noise in a light aircraft fuselage. The results indicate that improvements in the analytical model may be necessary for the prediction of interior noise of light aircraft.

76N28224*# ISSUE 19 PAGE 2420 CATEGORY 5 RPT#: NASA-TM-X-73922 76/07/00 42 PAGES UNCLASSIFIED DOCUMENT

UTTL: Study of operational parameters impacting helicopter fuel consumption --- using computer techniques (computer programs)

AUTH: A/CROSS, J. L.; B/STEVENS, D. D.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $4.00

MAJS: /*COMPUTER PROGRAMS/*COMPUTER TECHNIQUES/*FUEL CONSUMPTION/*HELICOPTERS

MINS: / AIRCRAFT FUELS/ NASA PROGRAMS/ RESEARCH AIRCRAFT/ TABLES (DATA)/ TECHNOLOGY UTILIZATION

ABA: Author

ABS: A computerized study of operational parameters affecting helicopter fuel consumption was conducted as an integral part of the NASA Civil Helicopter Technology Program. The study utilized the Helicopter Sizing and Performance Computer Program (HESCOMP) developed by the Boeing-Vertol Company and NASA Ames Research Center. An introduction to HESCOMP is incorporated in this report. The results presented were calculated using the NASA CH-53 civil helicopter research aircraft specifications. Plots from which optimum flight conditions for minimum fuel use that can be obtained are presented for this aircraft. The results of the study are considered to be generally indicative of trends for all helicopters.

76A33795*# ISSUE 16 PAGE 2428 CATEGORY 5
76/05/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: A review of some tilt-rotor aeroelastic research at NASA-Langley

AUTH: A/KVATERNIK, R. G. PAA: A/(NASA, Langley Research Center, Aeroelasticity Branch, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
Journal of Aircraft, vol. 13, May 1976, p. 357-363.

MAJS: /*AEROELASTICITY/*RESEARCH PROJECTS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*VERTICAL TAKEOFF AIRCRAFT

MINS: / BELL AIRCRAFT/ FLUTTER ANALYSIS/ GUST LOADS/ NASA PROGRAMS/ WIND TUNNEL MODELS

ABA: (Author)

ABS: An overview of an experimental and analytical research program conducted within the Aeroelasticity Branch of the NASA Langley Research Center for studying the aeroelastic and dynamic characteristics of tilt-rotor VTOL aircraft is presented. Selected results from several joint NASA/contractor investigations of scaled

models in the Langley transonic dynamics tunnel are shown and discussed with a view toward delineating various aspects of dynamic behavior peculiar to proprotor aircraft. Included are such items as proprotor/pylon stability, whirl flutter, gust response, and blade flapping. Theoretical predictions, based on analyses developed at Langley, are shown to be in agreement with the measured stability and response behavior.

77A29685*# ISSUE 12 PAGE 1953 CATEGORY 5
76/00/00 14 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotor Systems Research Aircraft /RSRA/ canopy explosive severance/fracture
AUTH: A/BEMENT, L. J. PAA: A/(NASA. Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: Symposium on Explosives and Pyrotechnics, 9th, Philadelphia, Pa., September 15, 16, 1976, Proceedings. (A77-29676 12-28) Philadelphia, Pa., Franklin Institute Research Laboratories, 1976, p. 24-1 to 24-14.
MAJS: /*CANOPIES/*COMPOUND HELICOPTERS/*ESCAPE SYSTEMS/* EXPLOSIVE DEVICES/*RESEARCH AIRCRAFT
MINS: / ACRYLIC RESINS/ DESIGN ANALYSIS/ FULL SCALE TESTS/ PANELS/ ROTARY WINGS
ABA: (Author)
ABS: The Rotor Systems Research Aircraft (RSRA), a compound rotor/fixed-wing aircraft, incorporates an emergency escape system for the three crew members; to achieve unobstructed egress, the overhead acrylic canopies of each crew member will be explosively severed and fractured into predictably small, low-mass pieces. A canopy explosive severance/fracture system was developed under this investigation that included the following system design considerations: selection of canopy and explosive materials, determining the acrylic's explosive severance and fracture characteristics, evaluating the effects of installation variables and temperature, determining the most effective explosive patterns, conducting full-scale, flat and double-curvature canopy tests, and evaluating the effects of back-blast of the explosive into the cockpit.

77A26687* ISSUE 11 PAGE 1762 CATEGORY 5
76/00/00 9 PAGES UNCLASSIFIED DOCUMENT
UTTL: Flight-test experience of a helicopter encountering an airplane trailing vortex
AUTH: A/DUNHAM, R. E., JR.; B/HOLBROOK, G. T.; C/CAMPBELL, R. L.; D/VAN GUNST, R. W.; E/MANTAY, W. R. PAA: D/(NASA, Langley Research Center, Hampton, Va.); E/(U.S. Army, Air Mobility Research and Development Laboratory, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Hampton, Va.
In: American Helicopter Society, Annual National Forum, 32nd, Washington, D.C., May 10-12, 1976, Proceedings. (A77-26851 11-01) Washington, D.C., American Helicopter Society, 1976, p. 1063-1 to 1063-8.
MAJS: /*AERODYNAMIC INTERFERENCE/*AIRCRAFT WAKES/*FLIGHT TESTS/*HELICOPTER PERFORMANCE
MINS: / C-54 AIRCRAFT/ ROTOR AERODYNAMICS/ UH-1 HELICOPTER/ VORTICES
ABA: (Author)
ABS: This paper presents results of a flight-test experiment of a UH-1H helicopter encountering the vortex wake of a C-54 airplane. The helicopter was instrumented to record the pilot control inputs, determine the upset experience, and measure critical loads within the rotor system. During the flight-test program 132 penetrations of the vortex wake were made by the helicopter at separation distances from 3/8 to 6-1/2 nautical miles. Test results indicated that the helicopter upsets and the vortex induced blade loads experienced were minimal and well within safe limits. The upsets were very mild when compared to a typical response of a small airplane to the vortex wake of the C-54 airplane.

77A26877* ISSUE 11 PAGE 1772 CATEGORY 8
76/00/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: A study to determine the characteristic shapes of helicopter visual approach profiles
AUTH: A/MOEN, G. C.; B/DICARLO, D. J.; C/YENNI, K. R. PAA: A/(U.S. Army, Air Mobility Research and Development Laboratory, Hampton, Va.); C/(NASA, Langley Research Center, Hampton, Va.)
CORP: Army Air Mobility Research and Development Lab., Hampton, Va.; National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: American Helicopter Society, Annual National Forum, 32nd, Washington, D.C., May 10-12, 1976, Proceedings. (A77-26851 11-01) Washington, D.C., American Helicopter Society, 1976, p. 1044-1 to 1044-11.
MAJS: /*APPROACH CONTROL/*DECELERATION/*FLIGHT ALTITUDE/* FLIGHT TESTS/*HELICOPTER PERFORMANCE
MINS: / MATHEMATICAL MODELS/ PITCH (INCLINATION)
ABA: (Author)
ABS: On previous helicopter instrument approach studies, pilot comments frequently indicated that the

deceleration profiles were characterized by 'unnatural cues', and it was found that the pilots were comparing the motion and attitude cues with those obtained during visual approaches. Prior to this study, the characteristic shape of visual approach profiles had not been formally documented. Over 200 visual approaches were flown using different helicopter types, test subjects, and initial conditions, and the altitude and groundspeed profiles were measured by a precision tracking radar. The data from each approach were then processed, and the characteristic shape of the altitude, groundspeed, and deceleration profiles was determined for each set of initial conditions. These flight data were processed further using graphical analysis techniques and parameterization, which, in turn, led to developing closed-form equations that accurately describe the characteristic groundspeed and deceleration profiles. Results from this study can be used to select instrument approach profiles, to develop instrument approach control laws, and to define the corresponding hardware requirements.

77A26870* ISSUE 11 PAGE 1761 CATEGORY 5
76/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: A critical examination of the flap-lag dynamics of helicopter rotor blades in hover and in forward flight

AUTH: A/KAZA, K. R. V.; B/KVATERNIK, R. G. PAA: B/(NASA, Langley Research Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

In: American Helicopter Society, Annual National Forum, 32nd, Washington, D.C., May 10-12, 1976, Proceedings. (A77-26851 11-01) Washington, D.C., American Helicopter Society, 1976, p. 1034-1 to 1034-14.

MAJS: /*AERODYNAMIC STABILITY/*FLAPPING/*HELICOPTER PERFORMANCE/*ROTARY WINGS

MINS: / LAPLACE TRANSFORMATION/ MATHEMATICAL MODELS/ PERTURBATION THEORY/ STEADY STATE

ABA: (Author)

ABS: A critical examination of flap-lag stability of a centrally hinged, spring-restrained rigid blade in both hover and forward flight is presented. Several differences in the equations of motion for blade flap-lag stability in the existing literature are identified. A rigorous and systematic development of these equations for a rigid articulated blade in forward flight shows the existence of some linear aerodynamic coupling terms associated with blade steady-state flapping and lagging in the perturbation equations. The differences identified are shown to be associated with the order in which the flap and lag transformations are taken in developing the equations of motion. The implications of these differences on stability are examined, and it is shown that the pitch-lag coupling terms associated with a flap-lag hinge transformation sequence have a marked influence on flap-lag stability. Some qualitative considerations on the role of the assumed transformation sequence in the development of the flap-lag equations for a hingeless elastic blade are also given. On the basis of these considerations, it is shown that aerodynamic coupling terms associated with blade steady-state flapping and lagging similar to those found for the rigid blade will also appear in the equations for the elastic blade.

77A20680* ISSUE 7 PAGE 1096 CATEGORY 63
76/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: On the design of optimal controllers with certain structural constraints

AUTH: A/JOSHI, S. M. PAA: A/(NASA, Langley Research Center, Hampton; Old Dominion University Research Foundation, Norfolk, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Old Dominion Univ., Norfolk, Va.

In: Annual Southeastern Symposium on System Theory, 8th, Knoxville, Tenn., Apr. 26, 27, 1976, Proceedings. (A77-20679 07-63) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 22-26.

MAJS: /*DYNAMIC CONTROL/*FEEDBACK CONTROL/*LINEAR SYSTEMS/*OPTIMAL CONTROL/*STOCHASTIC PROCESSES/*WHITE NOISE

MINS: / COMPENSATORS/ CONSTRAINTS/ CONTROL THEORY/ HELICOPTER DESIGN/ REGULATORS/ SPACE STATIONS/ SPACECRAFT DESIGN/ TIME CONSTANT

ABA: (Author)

ABS: This paper considers the problem of designing certain structurally constrained optimal regulators for linear systems subjected to additive white process noise and measurement noise. Three types of controller structures are considered, using direct output feedback, prespecified time constant filters, and optimal dynamic compensators. Necessary conditions are obtained for minimizing quadratic performance criteria. The techniques are demonstrated by application to a helicopter/slung load system, and a flexible space station.

76A38641*# ISSUE 19 PAGE 2915 CATEGORY 9
76/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: A general rotor model system for wind-tunnel investigation of rotorcraft aerodynamics and acoustics

AUTH: A/WILSON, J. C. PAA: A/(NASA. Langley Research Center; U.S. Army, Air Mobility Research and Development Laboratory, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: Aerodynamic Testing Conference, 9th, Arlington, Tex., June 7-9, 1976, Proceedings. (A76-38626 19-02) New York, American Institute of Aeronautics and Astronautics, Inc., 1976. p. 136-142.

MAJS: /*AERODYNAMIC NOISE/*AIRCRAFT CONFIGURATIONS/*RESEARCH AIRCRAFT/*ROTARY WING AIRCRAFT/*ROTOR AERODYNAMICS/* WIND TUNNEL TESTS

MINS: / AERODYNAMIC CONFIGURATIONS/ AIRCRAFT PERFORMANCE/ AIRCRAFT STABILITY/ CONTROL STABILITY/ RESEARCH AND DEVELOPMENT/ TAIL ROTORS/ V/STOL AIRCRAFT/ WIND TUNNEL MODELS

ABA: (Author)

ABS: A complex rotorcraft model system has been developed by the NASA Langley Research Center and the U.S. Army Air Mobility R&D Laboratory, Langley Directorate, for aerodynamic and acoustic experimental investigations in the NASA Langley V/STOL tunnel. This generalized rotor model system has a powered main rotor, tail rotor, and auxiliary engine capability. It may be configured to represent a variety of rotorcraft configurations. The first investigation was conducted to determine the performance, acoustic, stability and control characteristics of the NASA/Army Rotor Systems Research Aircraft with an articulated rotor. In a second investigation, a quarter-scale AH-1G configuration with a teetering rotor is being represented to determine if a V-tail will improve the directional characteristics. Future programs are planned to investigate advanced rotor blade airfoils for improved performance and acoustic characteristics.

76A36922*# ISSUE 17 PAGE 2590 CATEGORY 5
76/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flight investigation of the response of a helicopter to the trailing vortex of a fixed-wing aircraft

AUTH: A/MANTAY, W. R.; B/HOLBROOK, G. T.; C/CAMPBELL, R. L.; D/TOMAINE, R. L. PAA: D/(NASA. Langley Research Center, Hampton, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In: Atmospheric Flight Mechanics Conference, 3rd, Arlington, Tex., June 7-9, 1976, Proceedings. (A76-36901 17-08) New York, American Institute of Aeronautics and Astronautics, Inc., 1976. p. 192-200.

MAJS: /*AIRCRAFT WAKES/*DYNAMIC RESPONSE/*FIXED WINGS/* FLIGHT TESTS/*HELICOPTER PERFORMANCE/*VORTEX STREETS

MINS: / C-54 AIRCRAFT/ DIGITAL SIMULATION/ HELICOPTER TAIL ROTORS/ ROTARY WINGS/ UH-1 HELICOPTER/ VORTEX GENERATORS/ WING TIP VORTICES

ABA: (Author)

ABS: A flight investigation was conducted to quantitatively determine the response of a medium-weight helicopter to the trailing-vortex system of a fixed-wing aircraft. Flight tests and analytical tools were both utilized in the investigation. The flight tests involved an extensively instrumented UH-1H helicopter and a C-54 aircraft. Penetrations of the vortex system by the UH-1H were made at the following nominal conditions: the C-54 flew at 5500 feet altitude at a nominal gross weight of 58,000 pounds and an indicated airspeed of 115 knots in a cruise configuration. The UH-1H, nominally 7200 pounds gross weight, flew at 60 knots indicated airspeed during the penetrations at separation distances of 6.64 nautical miles to 0.42 nautical mile between aircraft. In general, the data analyzed for the above tests indicated that no unsafe penetration occurred. Further, penetrating vehicle attitude changes and structural loads were nominal. In addition, the response of the helicopter did not change appreciably with decreased separation distance.

78N78053* CATEGORY 5 RPT#: NASA-TM-X-72818-SUPPL
76/00/00 225 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aerodynamic characteristics of a powered tilt-proprotor wind tunnel model

AUTH: A/WILSON, J. C.; B/MINECK, R. E.; C/FREEMAN, C. E.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS

MAJS: /*AERODYNAMIC CHARACTERISTICS/*TILT ROTOR AIRCRAFT/* TILTED PROPELLERS/*WIND TUNNEL MODELS

MINS: / DATA PROCESSING/ GIMBALS/ PROPULSION SYSTEM PERFORMANCE/ TABLES (DATA)

77N21025*# ISSUE 12 PAGE 1535 CATEGORY 5
76/00/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Determination of subcritical damping by moving-block/randomdec applications

AUTH: A/HAMMOND, C. E.; B/DOGGETT, R. V., JR. PAA: A/(Army Air Mobility R&D Lab., Langley, Va.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A21/MF A01
In Its Flutter Testing Tech., p 59-76 (SEE N77-21022 12-01)

MAJS: /*AEROELASTICITY/*COMPUTER GRAPHICS/*ELASTIC DAMPING/* FLUTTER ANALYSIS/*RANDOM VIBRATION/*WIND TUNNEL TESTS
MINS: / AIRCRAFT STRUCTURES/ DYNAMIC RESPONSE/ FIXED WINGS/ HELICOPTER PERFORMANCE/ MODAL RESPONSE
ABA: Author
ABS: Two techniques are described which allow the determination of subcritical dampings and frequencies during aeroelastic testing of flight vehicles. The moving-block technique is shown to have the advantage of being able to provide damping and frequency information for each mode which might be present in a signal trace, but it has the disadvantage of requiring that the structure be excited transiently. The randomdec technique requires only random turbulence for excitation, but the randomdec signature is difficult to analyze when more than one mode is present. It is shown that by using the moving-block technique to analyze the randomdec signatures, the best features of both methods are gained. Examples are presented illustrating the direct application of the moving-block method to model helicopter rotor testing and application of the combined moving-block/randomdec method to flutter studies of two fixed-wing models.

77N21022*# ISSUE 12 PAGE 1535 CATEGORY 1 RPT#: NASA-SP-415 76/00/00 483 PAGES UNCLASSIFIED DOCUMENT
UTTL: Flutter Testing Techniques
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A21/MF A01
Conf. Proc. held at Dryden Flight Res. Center in Edwards, Calif., 9-10 Oct. 1975
MAJS: /*AERODYNAMIC NOISE/*AEROELASTICITY/*CONFERENCES/* FLUTTER ANALYSIS/*REAL TIME OPERATION
MINS: / MODAL RESPONSE/ PREDICTION ANALYSIS TECHNIQUES/ RANDOM VIBRATION/ ROTARY WING AIRCRAFT/ WIND TUNNEL TESTS
ANN: Developments in methodology and data analysis techniques for flutter testing in flight and on the ground are discussed.

76N16760* ISSUE 7 PAGE 893 CATEGORY 53 75/11/00 20 PAGES UNCLASSIFIED DOCUMENT
UTTL: Vehicle for civil helicopter ride quality research
AUTH: A/SNYDER, W. J.; B/SCHLEGEL, R. G. PAA: B/(Sikorsky Aircraft)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In its The 1975 Ride Quality Symp. p 97-116 (SEE N76-16754 07-53)
MAJS: /*CIVIL AVIATION/*COMFORT/*HELICOPTERS/*PASSENGERS
MINS: / AIR CONDITIONING/ FLIGHT TESTS/ NOISE INTENSITY/ VIBRATION MEASUREMENT
ABA: Author
ABS: A research aircraft for investigating the factors involved in civil helicopter operations was developed for NASA Langley Research Center. The aircraft is a reconfigured 17000 kg (36000 lb) military transport helicopter. The basic aircraft was reconfigured with advanced acoustic treatment, air-conditioning, and a 16-seat airline cabin. During the spring of 1975, the aircraft was flight tested to measure interior environment characteristics - noise and vibration - and was flown on 60 subjective flight missions with over 600 different subjects. Data flights established noise levels somewhat higher than expected, with a pure tone at 1400 Hz and vertical vibration levels between 0.07g and 0.17g. The noise and vibration levels were documented during subjective flight evaluations as being the primary source of discomfort. The aircraft will be utilized to document in detail the impact of various noise and vibration levels on passenger comfort during typical short-haul missions.

76N14579*# ISSUE 5 PAGE 600 CATEGORY 43 RPT#: NASA-TM-X-72802 75/11/00 62 PAGES UNCLASSIFIED DOCUMENT
UTTL: National Aeronautics and Space Administration operations: Remote sensing experiments in the New York Bight, 7-17 April 1975
AUTH: A/USRY, J. W.; B/HALL, J. B., JR.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $4.50
MAJS: /*AERIAL RECONNAISSANCE/*EARTH RESOURCES PROGRAM/* OCEANOGRAPHY/*REMOTE SENSORS
MINS: / EARTH RESOURCES/ EARTH RESOURCES SURVEY AIRCRAFT/ PERFORMANCE/ TECHNOLOGY ASSESSMENT
ABA: Author
ABS: Results are given of remote sensing experiments conducted in the New York Bight between April 7-17, 1975, to evaluate the role of remote sensing technology to aid in monitoring ocean dumping. Remote sensors were flown on the C-54, U-2, and C-130 aircraft while the National Oceanic and Atmospheric Administration obtained concurrent in situ sea truth data using helicopters and surface platforms. The test site, aircraft platforms, experiments, and supporting sensors are described. The operation of each aircraft are discussed and aircraft flight lines, flight parameters, and data identification parameters are presented in figures and tables.

75N33000*# ISSUE 24 PAGE 2995 CATEGORY 2 RPT#: NASA-TN-D-7917 L-10045 75/10/00 82 PAGES UNCLASSIFIED DOCUMENT

UTTL: A momentum analysis of helicopters and autogyros in inclined descent, with comments on operational restrictions

AUTH: A/HEYSON, H. H.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $4.75
Washington

MAJS: /*AUTOGYROS/*HELICOPTERS/*MOMENTUM THEORY/*OPERATIONAL PROBLEMS

MINS: / AERODYNAMIC COEFFICIENTS/ DESCENT/ FLIGHT TESTS/ LIFT/ PERFORMANCE PREDICTION/ ROTARY WINGS

ABA: Author

ABS: A momentum theory was developed for rotors in descending flight. Comparison with available experimental data indicates that the theory, when properly interpreted, yields the optimum performance of the rotor. Power settling can be explained on the basis of the theory. The reasons and the need for operational restrictions on descending flight are discussed. The maximum autorotative performance of a rotor is determined; the theory shows good agreement with flight measurements in autorotation. Similar equations were developed for a wing; it was shown that the ideal performance of an autorotating rotor is identical to that of a wing of equal aspect ratio. A limiting maximum wing lift coefficient which is confirmed by existing experimental data was obtained.

75N29198*# ISSUE 20 PAGE 2497 CATEGORY 24 RPT#: NASA-TM-X-72713 75/08/00 51 PAGES UNCLASSIFIED DOCUMENT

UTTL: Recent NASA progress in composites --- application to spacecraft and aircraft structures

AUTH: A/HELDENFELS, R. R.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $4.25
Presented at USAF/NASA Symp. on Composites, an Assessment of the Future, Washington, D. C., 11-12 Jun. 1975

MAJS: /*AIRCRAFT STRUCTURES/*COMPOSITE MATERIALS/*SPACECRAFT STRUCTURES

MINS: / AIRCRAFT DESIGN/ AIRCRAFT ENGINES/ AIRFRAME MATERIALS/ HELICOPTER DESIGN/ SPACECRAFT DESIGN

ABA: Author

ABS: The application of composites in aerospace vehicle structures is reviewed. Research and technology program results and specific applications to space vehicles, aircraft engines, and aircraft and helicopter structures are discussed in detail. Particular emphasis is given to flight service evaluation programs that are or will be accumulating substantial experience with secondary and primary structural components on military and commercial aircraft to increase confidence in their use.

75N28045*# ISSUE 15 PAGE 2344 CATEGORY 3 RPT#: NASA-TN-D-8000 L-10149 75/08/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Operational experiences of a commercial helicopter flown in a large metropolitan area

AUTH: A/DICARLO, D. J.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $3.25
Washington

MAJS: /*COMMERCIAL AIRCRAFT/*HELICOPTER PERFORMANCE

MINS: / FLIGHT CHARACTERISTICS/ HELICOPTER DESIGN/ SERVICE LIFE

ABA: Author

ABS: A survey of commercial helicopter-operating experiences was conducted using a helicopter flight recorder in order to provide a basis for extending helicopter design and service-life criteria. These data are representative of 182 flight hours accumulated during 1414 flights comprised of the separate legs of the total route structure employed. The operating experiences are presented in terms of the time spent within different airspeed brackets, within the classifiable flight conditions of climb, en route, and descent, at various rates of climb and descent, and at different rotor rotational speeds. The results indicated that the helicopter spent a majority of the flight time at airspeeds either below 40 knots or above 100 knots. Rates of climb and descent were concentrated at values below 5.1 m/s (1000 ft/min) particularly for higher airspeeds. Normal acceleration experiences were low, both in the total number and peak value realized; however, an extremely large number of pitch angular-velocity experiences were noted. Rotor rotational speeds were normal with no occurrences above the upper red-line limit.

75N29116*# ISSUE 20 PAGE 2486 CATEGORY 7 RPT#: NASA-TM-X-72759 75/07/22 92 PAGES UNCLASSIFIED DOCUMENT

UTTL: A computer program for helicopter rotor noise using Lowson's formula in the time domain

AUTH: A/PARKS, C. L.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC

MAJS: /*AIRCRAFT NOISE/*COMPUTER PROGRAMS/*ROTARY WINGS
MINS: / ACOUSTIC MEASUREMENT/ HELICOPTERS/ TIME
ABA: Author
ABS: A computer program (D3910) was developed to calculate both the far field and near field acoustic pressure signature of a tilted rotor in hover or uniform forward speed. The analysis, carried out in the time domain, is based on Lowson's formulation of the accustic field of a moving force. The digital computer program is described, including methods used in the calculations, a flow chart, program D3910 source listing, instructions for the user, and two test cases with input and output listings and output plots.

75N30030* ISSUE 21 PAGE 2603 CATEGORY 8
75/06/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Potential benefits to short-haul transports through use of active controls
AUTH: A/CONNER, D. W.; B/THOMPSON, G. O. PAA: B/(Boeing Co., Wichita, Kans.)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In AGARD Impact of Active Control Technol. on Airplane Design 10 p (SEE N75-30027 21-01)
MAJS: /*AIRCRAFT CONTROL/*HELICOPTERS/*SHORT HAUL AIRCRAFT
MINS: / AIRCRAFT DESIGN/ AIRCRAFT STABILITY/ FLIGHT CONTROL/ GUST LOADS/ TRANSPORT AIRCRAFT/ WING LOADING
ABA: Author
ABS: The potential applications of active controls are examined for improving the characteristics of transport type aircraft used in short-haul service (1,000-kilometer range capability). The types of aircraft to meet future needs (quiet operation, congestion alleviation, fuel conservation, operating economy, and traveler acceptance) are identified as helicopters for shorter stage lengths and fixed wing aircraft of reduced field-length capability for longer stage lengths. Likely uses for active controls for these aircraft are examined regarding payoffs which can be expected and problems and constraints which must be dealt with. Uses showing significant benefits include augmented stability and control, gust-load alleviation, and ride smoothing. Gust-load alleviation is particularly effective for low-wing-loading aircraft employing conventional lift. Ride-smoothing systems are indicated to be the furthest advanced and ready for production commitment for those applications where they can be shown to have payoff.

75N30022* ISSUE 21 PAGE 2602 CATEGORY 8
75/05/00 18 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotor systems research aircraft (RSRA) requirements for, and contributions to, rotorcraft state estimation and parameter identification
AUTH: A/CONDON, G. W.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Hampton, Va.
In AGARD Methods for Aircraft State and Parameter Identification 18 p (SEE N75-29997 21-01) Prepared by Army Air Mobility Res. and Develop. Lab., Hampton, Va.
MAJS: /*AIRCRAFT STABILITY/*PARAMETERIZATION/*ROTARY WING AIRCRAFT/*STABILITY DERIVATIVES
MINS: / FLIGHT TESTS/ HELICOPTER PERFORMANCE/ PREDICTION ANALYSIS TECHNIQUES
ABA: Author
ABS: Rotor System Research Aircraft (RSRA) is designed to provide the capabilities necessary for the effective and efficient in-flight test and verification of promising rotor concepts and supporting technology developments. The RSRA requirements for, and possible contributions to, rotorcraft state estimation and parameter identification technology are discussed.

75N30019* ISSUE 21 PAGE 2602 CATEGORY 5
75/05/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Importance of helicopter dynamics to the mathematical model of the helicopter
AUTH: A/WHITE, W. F., JR.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Hampton, Va.
In AGARD Methods for Aircraft State and Parameter Identification 12 p (SEE N75-29997 21-01) Prepared by Army Air Mobility Res. and Develop. Lab., Hampton, Va.
MAJS: /*AIRCRAFT STABILITY/*HELICOPTER PERFORMANCE/*MATHEMATICAL MODELS/*PARAMETERIZATION
MINS: / COMPUTER PROGRAMS/ NONLINEAR EQUATIONS/ NUMERICAL ANALYSIS/ RESONANT FREQUENCIES/ ROTARY WINGS
ABA: Author
ABS: A mathematical model of the helicopter requires appropriate representation of the constituent elements of rotor dynamics. General-purpose programs that model a variety of configurations for a broad range of operating conditions result in varying and incompatible levels of sophistication. Analysis of specific dynamic problems facilitates the identification of configuration parameters which determine system behavior. For the present analysis, the nonlinear equations of a torsionally rigid hingeless rotor are linearized about an equilibrium condition to determine flap-lag stability

characteristics in hover. A collocation method was used to obtain the coupled natural frequencies and modes. These modes allow exact treatment of the effect of elastic coupling which more than compensates for the destabilizing inertial coupling. The sensitivity of damping to the number of modes was found to be small, and reasonable accuracy was obtained the first flapwise and edgewise coupled modes. The range of destabilizing precone was found to be small.

75N23556*# ISSUE 15 PAGE 1762 CATEGORY 5 RPT#: NASA-TM-X-72655 L-10076 75/05/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: A study of helicopter interior noise reduction
AUTH: A/HOWLETT, J. T.; B/CLEVENSON, S. A.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $3.25
Presented at the 31st Ann. Natl. Forum of the Amer. Helicopter Soc., May 1975
MAJS: /*AIRCRAFT COMPARTMENTS/*HELICOPTERS/*NOISE REDUCTION
MINS: / AIRCRAFT NOISE/ VIBRATION
ABA: Author
ABS: The interior noise levels of existing helicopters are discussed along with an ongoing experimental program directed towards reducing these levels. Results of several noise and vibration measurements on Langley Research Center's Civil Helicopter Research Aircraft are presented, including measurements taken before and after installation of an acoustically-treated cabin. The predominant noise source in this helicopter is the first stage planetary gear-clash in the main gear box, both before and after installation of the acoustically treated cabin. Noise reductions of up to 20 db in some octave bands may be required in order to obtain interior noise levels comparable to commercial jet transports.

75N21249*# ISSUE 13 PAGE 1463 CATEGORY 2 RPT#: NASA-TM-X-3185 L-9454 75/03/00 209 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind tunnel investigation of helicopter-rotor wake effects on three helicopter fuselage models
AUTH: A/WILSON, J. C.; B/MINECK, R. E.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $7.25
Washington
MAJS: /*AERODYNAMIC CHARACTERISTICS/*HELICOPTER WAKES/*WIND TUNNEL TESTS
MINS: / FUSELAGES/ ROTOR AERODYNAMICS/ YAWING MOMENTS
ABA: Author
ABS: The effects of rotor wake on helicopter fuselage aerodynamic characteristics were investigated in the Langley V/STOL tunnel. Force, moment, and pressure data were obtained on three fuselage models at various combinations of windspeed, sideslip angle, and pitch angle. The data show that the influence of rotor wake on the helicopter fuselage yawing moment imposes a significant additional thrust requirement on the tail rotor of a single-rotor helicopter at high sideslip angles.

75N15607*# ISSUE 7 PAGE 727 CATEGORY 1 RPT#: NASA-TN-D-7796 L-9710 75/02/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: An analytical evaluation of airfoil sections for helicopter rotor applications
AUTH: A/BINGHAM, G. J.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.: Army Air Mobility Research and Development Lab., Hampton, Va. AVAIL.NTIS SAP: HC $3.25
Washington Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
MAJS: /*AERODYNAMIC DRAG/*AIRFOIL PROFILES/*HELICOPTER DESIGN/*ROTARY WINGS
MINS: / AERODYNAMIC CHARACTERISTICS/ NUMERICAL ANALYSIS/ PERFORMANCE PREDICTION
ABA: Author
ABS: An analytical technique was used to evaluate airfoils for helicopter rotor application. This technique permits assessment of the influences of airfoil geometric variations on drag divergence Mach number at lift coefficients from near zero to near maximum lift. Analytical results presented in this paper indicate the compromises in drag divergence Mach number which result from changes in (1) thickness ratio, (2) location of maximum thickness, (3) leading-edge radius, (4) camber addition, and (5) location of maximum camber of NACA four- and five-digit-series airfoils and some 6-series airfoils of potential interest for helicopters. Examples of airfoil sections which combine several of the geometric changes favorable to both advancing and retreating section performance have been presented.

76A22643* ISSUE 9 PAGE 1385 CATEGORY 63 75/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Design of optimal partial state feedback controllers for linear systems in stochastic environments
AUTH: A/JOSHI, S. M. PAA: A/(NASA, Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration. Langley

Research Center, Hampton, Va.
In: Electricity: An expanding technology; Proceedings of the Southeast Region 3 Conference, Charlotte, N.C., April 6-9, 1975. Volume 2. (A76-22626 09-31) New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 6D-4-1 to 6D-4-8.

MAJS: /*FEEDBACK CONTROL/*LINEAR SYSTEMS/*OPTIMAL CONTROL/*STOCHASTIC PROCESSES/*SYSTEMS ENGINEERING
MINS: / ALGORITHMS/ HELICOPTER CONTROL/ MATRICES (MATHEMATICS)/ WHITE NOISE/ WIND EFFECTS
ABA: (Author)
ABS: The problem of obtaining an optimal control law, which is constrained to be a feedback of the available measurements, is considered for both continuous and discrete time linear systems subjected to additive white process noise and measurement noise. Necessary conditions are obtained for minimizing a quadratic performance function for both finite and infinite duration cases. The feedback gain matrices are constrained to be constant for the infinite duration cases. For all the cases considered, algorithms are derived for generating sequences of feedback gain matrices which successively improve the performance function. Computational aspects are discussed via application to two continuous time processes, including a helicopter/slung load system subjected to measurement noise and random wind gust input.

76A11831* ISSUE 2 PAGE 221 CATEGORY 60
75/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: HOME - An application of fault-tolerant techniques and system self-testing --- independent computer for helicopter flight control command monitoring
AUTH: A/HOLDEN, D. J. PAA: A/(NASA, Langley Research Center, Hampton, Va.)
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
In: INTERCON 75; International Convention and Exposition, New York, N.Y., April 8-10, 1975, Conference Record. (A76-11826 02-33) New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 1 11/2-7 11/2.
MAJS: /*AIRBORNE/SPACEBORNE COMPUTERS/*COMPUTER DESIGN/*FAIL-SAFE SYSTEMS/*FLIGHT CONTROL/*IN-FLIGHT MONITORING/*RELIABILITY ENGINEERING
MINS: / AIRCRAFT RELIABILITY/ CIRCUIT RELIABILITY/ COMMAND AND CONTROL/ ELECTRONIC EQUIPMENT TESTS/ FLIGHT SAFETY / HELICOPTER DESIGN/ THRESHOLD LOGIC
ABA: (Author)
ABS: Hard Over Monitoring Equipment (HOME) has been designed to complement and enhance the flight safety of a flight research helicopter. HOME is an independent, highly reliable, and fail-safe special purpose computer that monitors the flight control commands issued by the flight control computer of the helicopter. In particular, HOME detects the issuance of a hazardous hard-over command for any of the four flight control axes and transfers the control of the helicopter to the flight safety pilot. The design of HOME incorporates certain reliability and fail-safe enhancement design features, such as triple modular redundancy, majority logic voting, fail-safe dual circuits, independent status monitors, in-flight self-test, and a built-in preflight exerciser. The HOME design and operation is described with special emphasis on the reliability and fail-safe aspects of the design.

75N12941*# ISSUE 4 PAGE 381 CATEGORY 5 RPT#: NASA-TM-X-3161 L-9923 74/12/00 71 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind tunnel investigation of a simulated gunship helicopter engine-exhaust-windstream interaction
AUTH: A/WILSON, J. C.; B/MINECK, R. E.
CORP: National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Hampton, Va.
AVAIL.NTIS SAP: HC $4.25
Washington Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.
MAJS: /*EXHAUST GASES/*HELICOPTER ENGINES/*WIND TUNNEL TESTS
MINS: / COWLINGS/ FLOW DEFLECTION/ FLOW VISUALIZATION/ FREE FLOW/ IMPINGEMENT/ WIND EFFECTS
ABA: Author
ABS: A wind tunnel investigation of the engine exhaust and windstream flow interaction on a gunship helicopter model was conducted in the Langley V/STOL tunnel. The investigation utilized a flow visualization technique employing neutrally buoyant helium filled bubbles to determine the cause of exhaust shield overheating during cruising flight and to evaluate means of eliminating the problem. The flow patterns were recorded with still cameras and on television magnetic tape. Exhaust flow impingement on the exhaust shield during cruise was found to cause the problem. Several flow altering devices were evaluated to find suitable ways to correct the problem. A flow deflector located on the model cowling upstream of the exhaust provides an effective solution.

75N12933*# ISSUE 4. PAGE 381 CATEGORY 5 RPT#:
NASA-TN-D-7786 L-9709 74/12/00 24 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Simulation study of intracity helicopter operations under instrument conditions to category 1 minimums

AUTH: A/CALLAN, W. M.; B/HOUCK, J. A.; C/DICARLO, D. J.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $3.25
Washington

MAJS: /*FLIGHT SIMULATORS/*HELICOPTERS/*URBAN TRANSPORTATION /*VISIBILITY

MINS: / AIR TRAFFIC CONTROL/ INSTRUMENT APPROACH/ INSTRUMENT FLIGHT RULES/ PILOT PERFORMANCE/ TRACKING STATIONS

ABA: Author

ABS: A fixed-base simulator study was conducted to define pilot workload and task performance associated with instrument flight operations for an intracity helicopter passenger service. Displays considered necessary to provide a minimal capability under Instrument Flight Rules conditions were used to fly a representative commercial helicopter route structure in the New York area, with each terminal assumed to be equipped with a precision approach guidance system. A cross section of pilots participated as test subjects, and despite the high workload level, the results indicated that for the assumptions employed, minimums of 61 m (200 ft) ceiling and 805 m (0.5 mile) visibility were feasible.

75N10009*# ISSUE 1 PAGE 2 CATEGORY 2 RPT#:
NASA-TN-D-7776 L-9744 74/11/20 23 PAGES
UNCLASSIFIED DOCUMENT

UTTL: An exploratory flight investigation of helicopter sling-load placements using a closed-circuit television as a pilot aid

AUTH: A/DICARLO, D. J.; B/KELLEY, H. L.; C/YENNI, K. R.
PAA: B/(US Army Air Mobility R and D Lab.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $3.25
Washington

MAJS: /*AIR CARGO/*HELICOPTER PERFORMANCE/*LOADING OPERATIONS/*TELEVISION SYSTEMS

MINS: / CLOSED CIRCUIT TELEVISION/ DELIVERY/ MATERIALS HANDLING/ POSITIONING

ABA: Author

ABS: Helicopter sling load operations have been limited during pick up and delivery of external cargo by the lack of precision achieved by the combination of pilot, helicopter, and sling load. Use of a closed circuit television as a pilot aid during sling load delivery and placement was documented along with additional cases representing procedures currently employed by military and commercial operators. Although an increase in pilot workload was noted when the television system was used, the results indicated a comparable level of performance for each test case.

75N11931*# ISSUE 3 PAGE 252 CATEGORY 5 RPT#:
NASA-TN-D-7694 L-9325 74/11/00 176 PAGES
UNCLASSIFIED DOCUMENT

UTTL: A wind-tunnel investigation of parameters affecting helicopter directional control at low speeds in ground effect

AUTH: A/YEAGER, W. T., JR.; B/YOUNG, W. H., JR.; C/KANTAY, W. R.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $7.00
Washington

MAJS: /*DIRECTIONAL CONTROL/*HELICOPTERS/*TAIL ASSEMBLIES/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC CHARACTERISTICS/ GROUND EFFECT/ HELICOPTER WAKES/ ROTOR AERODYNAMICS

ABA: Author

ABS: An investigation was conducted in the Langley full-scale tunnel to measure the performance of several helicopter tail-rotor/fin configurations with regard to directional control problems encountered at low speeds in ground effect. Tests were conducted at wind azimuths of 0 deg to 360 deg in increments of 30 deg and 60 deg and at wind speeds from 0 to 35 knots. The results indicate that at certain combinations of wind speed and wind azimuth, large increases in adverse fin force require correspondingly large increases in the tail-rotor thrust, collective pitch, and power required to maintain yaw trim. Changing the tail-rotor direction of rotation to top blade aft for either a pusher tail rotor (tail-rotor wake blowing away from fin) or a tractor tail rotor (tail-rotor wake blowing against fin) will alleviate this problem. For a pusher tail rotor at 180 deg wind azimuth, increases in the fin/tail-rotor gap were not found to have any significant influence on the overall vehicle directional control capability. Changing the tail rotor to a higher position was found to improve tail-rotor performance for a fin-off configuration at a wind azimuth of 180 deg. A V-tail configuration with a pusher tail rotor with top blade aft direction of rotation was found to be the best configuration with regard to overall directional control capability.

74N28506*# ISSUE 18 PAGE 2122 CATEGORY 2 RPT#: NASA-TN-D-7593 L-9371 74/07/00 42 PAGES
UNCLASSIFIED DOCUMENT

UTTL: A method of automatically stabilizing helicopter sling loads

AUTH: A/GERA, J.; B/FARMER, S. W., JR.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $3.25
Washington

MAJS: /*AIRCRAFT EQUIPMENT/*EXTERNAL STORES/*HELICOPTERS/* MATERIALS HANDLING

MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC STABILITY/ HELICOPTER CONTROL

ABA: Author

ABS: The effect of geometric and aerodynamic characteristics on the stability of the lateral degrees of freedom of a typical helicopter sling load is examined. The feasibility of stabilizing the suspended load by controllable fins was also studied. Linear control theory was applied to the design of a simple control law that stabilized the load over a wide range of helicopter airspeeds.

74N28102*# ISSUE 17 PAGE 2066 CATEGORY 21 RPT#: NASA-TN-D-7524 L-9311 74/07/00 42 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Flight investigation of manual and automatic VTOL decelerating instrument approaches and landings

AUTH: A/KELLY, J. R.; B/NIESSEN, F. R.; C/THIBODEAUX, J. J.; D/YENNI, K. R.; E/GARREN, J. F., JR.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $3.25
Washington

MAJS: /*AIRCRAFT LANDING/*HELICOPTERS/*INSTRUMENT LANDING SYSTEMS/*VERTICAL TAKEOFF AIRCRAFT

MINS: / APPROACH CONTROL/ AUTOMATIC LANDING CONTROL/ DISPLAY DEVICES/ FLIGHT SAFETY/ GLIDE PATHS

ABA: Author

ABS: A flight investigation was undertaken to study the problems associated with manual and automatic control of steep, decelerating instrument approaches and landings under simulated instrument conditions. The study was conducted with a research helicopter equipped with a three-cue flight-director indicator. The scope of the investigation included variations in the flight-director control laws, glide-path angle, deceleration profile, and control response characteristics. Investigation of the automatic-control problem resulted in the first automated approach and landing to a predetermined spot ever accomplished with a helicopter. Although well-controlled approaches and landings could be performed manually with the flight-director concept, pilot comments indicated the need for a better display which would more effectively integrate command and situation information.

74N29542*# ISSUE 19 PAGE 2554 CATEGORY 8 RPT#: NASA-TM-X-2872 L-9002 74/06/00 164 PAGES
UNCLASSIFIED DOCUMENT

UTTL: A real-time digital computer program for the simulation of a single rotor helicopter

AUTH: A/HOUCK, J. A.; B/GIBSON, L. H.; C/STEINMETZ, G. G. PAA: B/(Electronic Assoc., Inc.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $5.00
Washington

MAJS: /*COMPUTER PROGRAMS/*DIGITAL SIMULATION/*REAL TIME OPERATION/*SIKORSKY WHIRLWIND HELICOPTER

MINS: / COMPUTERIZED DESIGN/ HELICOPTER DESIGN/ MATHEMATICAL MODELS

ABA: Author

ABS: A computer program was developed for the study of a single-rotor helicopter on the Langley Research Center real-time digital simulation system. Descriptions of helicopter equations and data, program subroutines (including flow charts and listings), real-time simulation system routines, and program operation are included. Program usage is illustrated by standard check cases and a representative flight case.

74N21652*# ISSUE 13 PAGE 1502 CATEGORY 2 RPT#: NASA-TN-D-7495 L-8990 74/05/00 37 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Comparison of acoustic performance of five muffler configurations on a small helicopter --- acoustic properties of modified helicopter exhaust system

AUTH: A/PEGG, R. J.; B/HILTON, D. A.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $3.25
Washington

MAJS: /*ACOUSTIC MEASUREMENT/*BELL AIRCRAFT/*ENGINE NOISE/* EXHAUST GASES/*HELICOPTERS/*MUFFLERS/*NOISE REDUCTION

MINS: / ACOUSTIC PROPERTIES/ AIRCRAFT EQUIPMENT/ EQUIPMENT SPECIFICATIONS/ MUFFLERS

ABA: Author

ABS: A field noise measurement program has been conducted on a standard Bell 47 series helicopter and on one that had been modified with specially designed, airframe-mounted mufflers to reduce the engine exhaust noise. The purpose of the study was to evaluate the

accustic performance Of five experimental exhaust muffler configurations for a helicopter reciprocating engine in an operational environment. All muffler configurations produced beneficial engine exhaust noise reductions but some configurations were markedly better than others. Flyover noise results indicated that maximum overall noise reductions of approximately 8 db were obtained with the various mufflers. The rotor noise was judged to be the dominant noise component for the muffler-equipped helicopters whereas the engine noise was the dominant component for the basic configuration.

74N20659*# ISSUE 12 PAGE 1372 CATEGORY 2 RPT#: NASA-TM-X-71957 74/04/24 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: The noise environment of a school classroom due to the operation of utility helicopters --- acoustic measurements of helicopter noise during flight over building

AUTH: A/HILTON, D. A.; B/PEGG, R. J.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $4.00
Presented at 87th Meeting of the Acoust. Soc. of Am., New York City, 24 Apr. 1974

MAJS: /*ACOUSTIC MEASUREMENT/*AIRCRAFT NOISE/*HELICOPTERS/* NOISE INTENSITY/*UTILITY AIRCRAFT

MINS: / ACOUSTIC PROPERTIES/ HUMAN FACTORS ENGINEERING/ NOISE PROPAGATION/ NOISE SPECTRA

ABA: Author

ABS: Noise measurements under controlled conditions have been made inside and outside of a school building during flyover operations of four different helicopters. The helicopters were operated at a condition considered typical for a police patrol mission. Flyovers were made at an altitude of 500 ft and an airspeed of 45 miles per hour. During these operations acoustic measurements were made inside and outside of the school building with the windows closed and then open. The outside noise measurements during helicopter flyovers indicate that the outside db(A) levels were approximately the same for all test helicopters. For the windows closed case, significant reductions for the inside measured db(A) values were noted for all overflights. These reductions were approximately 20 db(A); similar reductions were noted in other subjective measuring units. The measured internal db(A) levels with the windows open exceeded published classroom noise criteria values; however, for the windows-closed case they are in general agreement with the criteria values.

74N18688*# ISSUE 10 PAGE 1123 CATEGORY 2 RPT#: NASA-TN-D-7452 L8923 74/04/00 30 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flight investigation of effects of a fan-in-fin yaw control concept on helicopter flying-quality characteristics

AUTH: A/KELLEY, H. L.; B/WEST, T. C.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Hampton, Va.
AVAIL.NTIS SAP: HC $3.25
Washington Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.

MAJS: /*AERODYNAMIC CONFIGURATIONS/*DIRECTIONAL CONTROL/* HELICOPTER CONTROL/*HELICOPTER PERFORMANCE

MINS: / DUCTED FANS/ FLIGHT TESTS/ HELICOPTER DESIGN/ YAWING MOMENTS

ABA: Author

ABS: Flight-test results which describe flying-quality factors related to the fan-in-fin yaw control concept as utilized on a pre-production version of a European helicopter are presented. Design compromises to be considered with this concept are also presented. The large, fixed vertical fin associated with the fan-in-fin system was helpful in maneuvering flight, but introduced several flying-quality problems when combined with the fan.

74N17758*# ISSUE 9 PAGE 1007 CATEGORY 2 RPT#: NASA-TM-X-3016 L-9430 74/03/00 36 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind tunnel investigation of simulated helicopter engine exhaust interacting with windstream

AUTH: A/SHAW, C. S.; B/WILSON, J. C.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Hampton, Va.
AVAIL.NTIS SAP: HC $3.25
Film Supplement Number L-1139 to this report is available on request from NASA. Langley Res. Center Attn: Photographic Branch, Mail Stop 171, Hampton, Va. 23665Washington Prepared in cooperation with Army Air Mobility R and D Lab., Hampton, Va.

MAJS: /*EXHAUST FLOW SIMULATION/*HELICOPTER ENGINES/*WIND TUNNEL TESTS

MINS: / FLOW DEFLECTION/ FLOW VISUALIZATION/ HEAT TRANSFER/ WIND (METEOROLOGY)

ABA: Author

ABS: A wind tunnel investigation of the windstream-engine exhaust flow interaction on a light observation helicopter model has been conducted in the Langley V/STOL tunnel. The investigation utilized flow visualization techniques to determine the cause to

ORIGINAL PAGE IS OF POOR QUALITY

determine the cause of exhaust shield overheating during cruise and to find a means of eliminating the problem. Exhaust flow attachment to the exhaust shield during cruise was found to cause the overheating. Several flow-altering devices were evaluated to find a suitable way to correct the problem. A flow deflector located on the model cowling upstream of the exhaust in addition to aerodynamic shield fairings provided the best solution. Also evaluated was heat transfer concept employing pin fins to cool future exhaust hardware. The primary flow visualization technique used in the investigation was a newly developed system employing neutrally buoyant helium-filled bubbles. The resultant flow patterns were recorded on motion picture film and on television magnetic tape.

77N16675*# ISSUE 7 PAGE 928 CATEGORY 48 RPT#: NASA-CP-2003 74/00/00 378 PAGES UNCLASSIFIED DOCUMENT

UTTL: Free Drifting Buoys

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A17/MF A01

Presented at Drift Buoy Symp., Hampton, Va., 22-23 May 1974; Sponsored by AIAA Tech. Comm. on Marine Systems and Technol.

MAJS: /*BUOYS/*OPTICAL TRACKING/*RADIO TRACKING/*TRACKING RADAR

MINS: / CONFERENCES/ DISPLAY DEVICES/ SATELLITE TRACKING/ SONAR

ABA: Author

ABS: Information was exchanged between people directly involved with the development, use, and/or potential use of free drifting buoys. Tracking systems and techniques, where methods and accuracy of optical, radio, radar, satellite, and sonic tracking of free-drifting buoys were discussed. Deployment and retrieval covering methods currently used or planned in the deployment and retrieval of free-drifting buoys from boats, ships, helicopters, fixed platforms, and fixed-wing aircraft were reported. Simulation, sensors, and data emphasizing the status of water circulation modeling, and sensors useful on free-drifting buoys, and data display and analysis were described.

73N31623*# ISSUE 22 PAGE 2700 CATEGORY 23 RPT#: NASA-TN-D-7309 L-8808 73/10/00 73 PAGES UNCLASSIFIED DOCUMENT

UTTL: An improved method for design of expansion-chamber mufflers with application to an operational helicopter

UNOC: Design and characteristics of expansion chamber mufflers for reducing exhaust noise generated by helicopters

AUTH: A/PARROTT, T. L.

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $3.50 Washington

MAJS: /*ENGINE NOISE/*EXHAUST SYSTEMS/*HELICOPTER ENGINES/* MUFFLERS/*NOISE REDUCTION

MINS: / ACOUSTIC PROPERTIES/ AIRCRAFT EQUIPMENT/ SYSTEMS ANALYSIS

ABA: Author

ABS: An improved method for the design of expansion-chamber mufflers is described and applied to the task of reducing exhaust noise generated by a helicopter. The method is an improvement of standard transmission-line theory in that it accounts for the effect of the mean exhaust-gas flow on the acoustic-transmission properties of a muffler system, including the termination boundary condition. The method has been computerized, and the computer program includes an optimization procedure that adjusts muffler component lengths to achieve a minimum specified desired transmission loss over a specified frequency range. A printout of the program is included together with a user-oriented description.

B2N72162* CATEGORY 5 RPT#: NASA-TM-84066 73/02/23 74 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/Army rotor systems research aircraft project plan

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS

MAJS: /*AIRCRAFT DESIGN/*PROJECT PLANNING/*RESEARCH AIRCRAFT /*ROTARY WING AIRCRAFT

MINS: / AIRCRAFT CONFIGURATIONS/ DYNAMIC STRUCTURAL ANALYSIS / FLIGHT CONTROL/ WIND TUNNEL TESTS

73N21044* ISSUE 12 PAGE 1361 CATEGORY 2 CNT#: DAHC04-68-C-0004 73/02/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: A compressible unsteady theory for helicopter rotors

UNOC: Analysis of unsteady aerodynamic loading on reference section of helicopter rotor blade in axial or hovering flight under compressible flow conditions

AUTH: A/HAMMOND, C. E.; B/PIERCE, G. A. PAA: B/(Ga. Inst. of Tech.)

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Fort Eustis, Va.

In AGARD Aerodyn. of Rotary Wings 15 p (SEE N73-21031 12-02) Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Ft. Eustis, Va.

MAJS: /*AERODYNAMIC CHARACTERISTICS/*AERODYNAMIC LOADS/* DOWNWASH/*HELICOPTER WAKES/*ROTARY WINGS
MINS: / COMPRESSIBLE FLOW/ HOVERING STABILITY/ NUMERICAL ANALYSIS/ PERFORMANCE PREDICTION/ PRESSURE DISTRIBUTION/ TURBULENT WAKES
ABA: Author
ABS: An aerodynamic theory is presented which allows the determination of the unsteady aerodynamic loading on a reference section of a helicopter rotor blade in axial or hovering flight under compressible flow conditions. The aerodynamics of the two-dimensional flow model are formulated using a kernel function approach. By introducing the acceleration potential the governing integral equation for the flow and its attendant downwash boundary condition are developed and solved numerically using a pressure mode assumption and a collocation technique. The compressible aerodynamic theory thus developed is compared analytically with two other existing theories, one incompressible and one compressible, and is shown to agree with these theories provided that the appropriate limit is taken so that the flow models agree. The ratio of blade oscillatory frequency to rotor rotational frequency is shown to be the correlation parameter between the two flow models.

73N21041* ISSUE 12 PAGE 1361 CATEGORY 1
73/02/00 20 PAGES UNCLASSIFIED DOCUMENT
UTTL: A summary of current research in rotor unsteady aerodynamics with emphasis on work at Langley Research Center
UNOC: Analysis of unsteady aerodynamic environment of rotary wings and research projects to improve understanding of rotor unsteady airfoils
AUTH: A/WARD, J. F.; B/YOUNG, W. H., JR.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Army Air Mobility Research and Development Lab., Fort Eustis, Va.
In ACARD Aerodyn. of Rotary Wings 20 p (SEE N73-21031 12-02) Prepared in cooperation with Army Air Mobility R and D Lab., Fort Eustis, Va.
MAJS: /*AERODYNAMIC CHARACTERISTICS/*AERODYNAMIC CONFIGURATIONS/*HELICOPTER PERFORMANCE/*ROTARY WINGS/* UNSTEADY FLOW
MINS: / AERODYNAMIC LOADS/ AERODYNAMIC STABILITY/ AERODYNAMIC STALLING/ RESEARCH PROJECTS
ABA: Author
ABS: The basic unsteady aerodynamic environment of the rotary wing is summarized. Some of the observed trends in the state of the art are discussed. Some of the research needs that will require attention are reported. A review of a number of research investigations as a part of a joint NASA/Army rotorcraft project is presented. The research is directed toward achieving a better understanding of rotor unsteady airfoils. The investigations include: (1) rotor maneuver loads; (2) level flight and maneuver wake prediction; (3) tip-vortex flow; (4) blade-vortex interactions; (5) dynamic stall; (6) transient Mach number air loads; and (7) development of variable geometry rotors.

77N70017* CATEGORY 98 73/00/00 10 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Isolation and damping: Ground tests of an active vibration isolation system for a full-scale helicopter
AUTH: A/HANKS, B. R.; B/SNYDER, W. J.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
In The Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 p 67-75 (SEE N77-70012 01-98)
MAJS: /*GROUND TESTS/*HELICOPTER PERFORMANCE/*LIFTING ROTORS /*VIBRATION DAMPING/*VIBRATION ISOLATORS
MINS: / AERODYNAMIC CHARACTERISTICS/ HUMAN FACTORS ENGINEERING/ HYDRAULIC CONTROL/ PERFORMANCE TESTS

72N33011* ISSUE 24 PAGE 3166 CATEGORY 2 RPT#: NASA-TM-X-67739 AD-732866 PA-TR-4240 71/10/00 84 PAGES UNCLASSIFIED DOCUMENT
UTTL: Cooperative program for design, fabrication, and testing of graphite/epoxy composite helicopter shafting
UNOC: Development and fabrication of UH-1 helicopter tail rotor drive shaft from graphite/epoxy composite materials TLSP: Progress Report
AUTH: A/WRIGHT, C. C.; B/BAKER, D. J.; C/CORVELLI, N.; D/THURSTON, L.; E/CLARY, R.; F/ILLG, W. PAA: A/(Picatinny Arsenal)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.; Picatinny Arsenal, Dover, N. J. AVAIL.NTIS SAP: HC $6.25
Prepared in cooperation with Picatinny Arsenal
MAJS: /*COMPOSITE MATERIALS/*HELICOPTER PROPELLER DRIVE/* UH-1 HELICOPTER
MINS: / EPOXY RESINS/ FABRICATION/ GRAPHITE/ PERFORMANCE TESTS
ABA: Author
ABS: The fabrication of UH-1 helicopter tail rotor drive shafts from graphite/epoxy composite materials is discussed. Procedures for eliminating wrinkles caused by lack of precure compaction are described. The development of the adhesive bond between aluminum end couplings and the composite tube is analyzed. Performance tests to validate the superiority of the

...ers are reported.

72N11018* ISSUE 2 PAGE 150 CATEGORY 2 RPT#:
NASA-CASE-LAR-10557 US-PATENT-3,592,559
US-PATENT-APPL-SN-853746 US-PATENT-CLASS-416-121
US-PATENT-CLASS-416-115 US-PATENT-CLASS-416-127
US-PATENT-CLASS-416-130 US-PATENT-CLASS-416-149
US-PATENT-CLASS-416-200 71/07/13 5 PAGES
UNCLASSIFIED DOCUMENT
Filed 28 Aug. 1969

UTTL: Variable geometry rotor system
UNOC: Variable geometry rotor system for direct control over wake vortex TLSP: Patent
AUTH: A/WARD, J. F. PAT: A/inventor (to NASA)
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. SAP: Avail: US Patent Office
Supersedes N70-22185 (08 - 09, p 1572)
MAJS: /*AERODYNAMIC CONFIGURATIONS/*HELICOPTER WAKES/*ROTARY WINGS
MINS: / AIRCRAFT NOISE/ NOISE REDUCTION/ PATENTS/ SYSTEMS ENGINEERING/ TIP SPEED/ VIBRATION/ VORTICES
ABA: Official Gazette of the U.S. Patent Office
ABS: The rotor system described is designed to control the nonuniform wake shed from a given rotor blade impinging upon the other blades of the rotor system. The rotor system utilizes blade sets which are of a different diameter than another blade set in the system. The azimuth spacing between the blade sets can be varied while the aircraft is in flight. The vertical spacing between the blade sets can also be changed. A mechanism is provided for collective pitch control of the blade sets. The planform of blade sets, as well as the configuration of their tips, are varied.

71N20191*# ISSUE 9 PAGE 1366 CATEGORY 11 RPT#:
NASA-TN-D-6118 L-7432 CNT#: 721-60-10-01 71/03/00
40 PAGES UNCLASSIFIED DOCUMENT

UTTL: A wind tunnel investigation of helicopter directional control in rearward flight in ground effect
UNOC: Wind tunnel investigation of helicopter directional control in rearward flight in ground effect
AUTH: A/HUSTON, R. J.; B/MORRIS, C. E. K., JR.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS
WASHINGTON
MAJS: /*AERODYNAMICS/*DIRECTIONAL CONTROL/*GROUND EFFECT/*HELICOPTERS/*ROTOR AERODYNAMICS/*TAIL ASSEMBLIES/*WIND TUNNEL STABILITY TESTS

72N20005*# ISSUE 11 PAGE 1419 CATEGORY 2 RPT#:
NASA-TM-X-2226 L-7237 71/02/00 40 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Ground noise measurements during flyover hover, landing, and take-off operations of a standard and a modified HH-43B helicopter
UNOC: Field noise measurements of HH-43B helicopters during flight to determine effects of modifications on noise reduction
AUTH: A/HILTON, D. A.; B/HENDERSON, H. R.; C/PEGG, R. J.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS
Washington
MAJS: /*AERODYNAMIC NOISE/*H-43 HELICOPTER/*NOISE REDUCTION
MINS: / ACOUSTIC MEASUREMENT/ DATA ACQUISITION/ FLIGHT TESTS
ABA: Author
ABS: A field noise measurement program has been conducted on a standard HH-43B helicopter and one that had been modified by reducing the rotor speed, altering rotor tip shape, and treating the engine exhaust and inlet to reduce the external noise levels. The modifications were limited to those which could easily be made on a standard helicopter; consequently, only modest noise reductions were expected. The ground noise characteristics of each helicopter during flyby, hover, landing, and take-off operations are presented. Based on an analysis of the measured results, the average of the overa' on-track nc.se levels of the modified helicopter was approximately 3 dB lower than for the standard helicopter. Narrow-band-spectra data of the hovering helicopter show a reduction in the overall noise due to the engine exhaust and a general reduction in harmonic content throughout the spectrum for the modified helicopter. The noise results of the test program are found to correlate generally with previous noise measurements on this type of aircraft, and the noise reductions are within a range expected from the modifications which were incorporated.

72N13015*# ISSUE 4 PAGE 433 CATEGORY 2
71/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotorcraft applications and technology
UNOC: Technological developments for improved helicopter design and operational capabilities
AUTH: A/LAPSCOTT, R. J.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC $6.00/MF $0.95
In its Vehicle Technol. for Civil Aviation p 345-358
(SEE N72-12995 04-02
MAJS: /*CIVIL AVIATION/*HELICOPTER DESIGN/*HELICOPTER PERFORMANCE/*TECHNOLOGICAL FORECASTING/*TRANSPORT AIRCRAFT

MINS: / AIRCRAFT STRUCTURES/ AIRLINE OPERATIONS/ CONFERENCES / PROPULSION SYSTEM CONFIGURATIONS/ STRUCTURAL ANALYSIS
ABA: Author
ABS: The helicopter, because of its inherent advantage of lifting capability at hover or low speeds for long periods of time, is finding increased usage even without special attention to the development of economical and operationally suitable vehicles for this kind of applications. The principle targets for the application of technology to improve the helicopter are propulsion systems, noise abatement, vibration and structural integrity, and instrument flight capability. Aeroelastic analysis, structural concepts, and rotor geometry are discussed and some of the technologies relating to instrument flight for helicopters are indicated.

71N30775*# ISSUE 18 PAGE 2870 CATEGORY 2
71/00/00 13 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analysis of some helicopter operating problems
UNOC: Systems analysis of directional control, rotary wing vibratory loads, lift sharing, and fuselage vibration and damping during helicopter maneuvers
AUTH: A/JENKINS, J. L., JR.; B/MORRIS, C. E. K., JR.; C/SNYDER, W. J.; D/WARD, J. F.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: AVAIL- NTIS HC $6.00/MF $0.95
IN ITS NASA AIRCRAFT SAFETY AND OPERATING PROBL., VOL. 1 1971 P 249-261 /SEE N71-30756 18-02/
MAJS: /*DIRECTIONAL CONTROL/*HELICOPTERS/*STRUCTURAL VIBRATION/*SYSTEMS ANALYSIS/*VIBRATORY LOADS
MINS: / CONFERENCES/ FUSELAGES/ LIFT/ ROTARY WINGS/ VIBRATION DAMPING

70N41183*# ISSUE 23 PAGE 4244 CATEGORY 2 RPT#: NASA-TN-D-6025 L-7241 CNT#: 721-05-10-02 70/10/00
24 PAGES UNCLASSIFIED DOCUMENT
UTTL: Evaluation of a moving-graph instrument display for landing approaches with a helicopter
UNOC: Moving graph instrument display evaluation for landing approaches with helicopter
AUTH: A/DURHAM, R. E., JR.; B/SOMMER, R. W.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS
WASHINGTON
MAJS: /*FLIGHT TESTS/*HELICOPTERS/*LANDING AIDS/*MOVING TARGET INDICATORS
MINS: / DISPLAY DEVICES/ SIMULATION/ VERTICAL LANDING/ VERTICAL TAKEOFF

70N40667*# ISSUE 23 PAGE 4238 CATEGORY 2 RPT#: NASA-TN-D-5893 L-6995 CNT#: 124-07-17-19 70/10/00
91 PAGES UNCLASSIFIED DOCUMENT
UTTL: Model wind-tunnel and flight investigation of a parawing lifting body landing system
UNOC: Wind tunnel model and flight tests of parawing lifting body landing system
AUTH: A/NAESETH, R. L.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS
WASHINGTON
MAJS: /*FLIGHT TESTS/*LIFTING REENTRY VEHICLES/*PARAWINGS/*WIND TUNNEL MODELS
MINS: / HELICOPTERS/ LANDING AIDS/ LANDING MODULES/ TABLES (DATA)

70N31863*# ISSUE 16 PAGE 2956 CATEGORY 11
RPT#: NASA-TN-D-5819 L-7042 CNT#: 721-01-12-01-23
70/06/00 329 PAGES UNCLASSIFIED DOCUMENT
UTTL: Theoretical study of conditions limiting V/STOL testing in wind tunnels with solid floor
UNOC: Conditions limiting V/STOL testing in wind tunnels with solid floors
AUTH: A/HEYSON, H. H.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS
WASHINGTON
MAJS: /*HELICOPTER WAKES/*V/STOL AIRCRAFT/*WIND TUNNELS
MINS: / DOWNWASH/ GRAPHS (CHARTS)/ GROUND EFFECT/ ROTARY WINGS/ TABLES (DATA)

70N16136*# ISSUE 5 CATEGORY 2 RPT#: NASA-TN-D-5602 L-6661 CNT#: 721-05-10-06-23
70/01/00 33 PAGES UNCLASSIFIED DOCUMENT
UTTL: Investigation of level-flight and maneuvering characteristics of a hingeless-rotor compound helicopter
UNOC: Flight tests on hingeless rotor compound helicopter to determine level flight and maneuvering characteristics
AUTH: A/DEAL, P. L.; B/JENKINS, J. L., JR.
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS
WASHINGTON
MAJS: /*COMPOUND HELICOPTERS/*FLIGHT TESTS/*HELICOPTER PERFORMANCE/*MANEUVERABILITY/*ROTOR LIFT
MINS: / LEVEL (HORIZONTAL)/ LIFTING ROTORS

PRINT 31/2/1-39 TERMINAL=20

82A28322*# ISSUE 12 PAGE 1859 CATEGORY 5 RPT#: AIAA PAPER 82-0286 CNT#: NAG3-109 NAG3-242
82/01/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Performance degradation of propeller/rotor systems due to rime ice accretion

AUTH: A/KORKAN, K. D.; B/DADONE, L.; C/SHAW, R. J. PAA: A/(Texas A & M University, College Station, TX); B/(Boeing Vertol Co., Philadelphia, PA); C/(NASA, Lewis Research Center, Cleveland, OH)

CORP: Texas A&M Univ., College Station.; Boeing Vertol Co., Philadelphia, Pa.; National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, 14 p.

MAJS: /*HELICOPTER PERFORMANCE/*ICE FORMATION/*MATHEMATICAL MODELS/*PERFORMANCE PREDICTION/*PROPELLER EFFICIENCY

MINS: / FLIGHT CHARACTERISTICS/ POWER EFFICIENCY/ ROTARY WINGS/ THRUST/ TIME DEPENDENCE/ TORQUE

ABA: (Author)

ABS: A theoretical model has been established which is applicable to both propeller and helicopter systems that determines the effect of rime ice accretion on the thrust coefficient, power coefficient, and efficiency as a function of time in a natural icing condition. Theoretical comparisons have been made with experimentally determined decrease in propeller thrust coefficient and efficiency for five natural icing conditions with good agreement. The present analytical model is also applicable to the helicopter case, where the method predicts radial and azimuthal rotor blade ice shapes in addition to torque rise as a function of time in a natural icing condition.

82N21148*# ISSUE 12 PAGE 1602 CATEGORY 3
81/12/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/Lewis Research Center Icing Research Program

AUTH: A/EVANICH, P. L.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A07/MF A01

In NASA. Marshall Space Flight Center Proc.: 5th Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems data p 64-75 (SEE N82-21139 12-01)

MAJS: /*AIRFOILS/*COMMERCIAL AIRCRAFT/*GENERAL AVIATION AIRCRAFT/*ICE ENVIRONMENTS/*ICE FORMATION/*ROTORCRAFT AIRCRAFT

MINS: / AIRCRAFT STRUCTURES/ ENVIRONMENT SIMULATION/ ICE PREVENTION/ METEOROLOGICAL PARAMETERS/ NUMERICAL ANALYSIS/ PILOT TRAINING

ABA: E.A.K.

ABS: Icing requirements for commercial aircraft, light transport and general aviation aircraft, and rotorcraft were studied. The objectives was to: establish the state of the art in aircraft icing, determining the aircraft industry's icing research and technology needs, and recommending both short and long term icing programs to NASA. It is shown that all three categories of aircraft need improved and new ice protection system, icing calculational techniques, icing performance sensitivity on current and modern airfoils, and new and improved icing facilities. The need for a general aviation pilot training film concerning flight into icing conditions is also identified.

82N15040*# ISSUE 6 PAGE 722 CATEGORY 7 RPT#: NASA-TP-1945 E-556 81/12/00 40 PAGES UNCLASSIFIED DOCUMENT

UTTL: Effect of fuel injector type on performance and emissions of reverse-flow combustor

AUTH: A/NORGREN, C. T.; B/RIDDLEBAUGH, S. M.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*COMBUSTION CHAMBERS/*FUEL INJECTION/*GAS TURBINE ENGINES/*PERFORMANCE TESTS

MINS: / ENGINE TESTS/ HELICOPTERS/ INJECTORS/ JET ENGINES

ABA: Author

ABS: The combustion process in a reverse-flow combustor suitable for a small gas turbine engine was investigated to evaluate the effect of fuel injector type on performance and emissions. Fuel injector configurations using pressure-atomizing, spill-flow, air blast, and air-assist techniques were compared and evaluated on the basis of performance obtained in a full-scale experimental combustor operated at inlet conditions corresponding to takeoff, cruise, low power, and idle and typical of a 16:1-pressure-ratio turbine engine. Major differences in combustor performance and emissions characteristics were experienced with each injector type even though the aerodynamic configuration was common to most combustor models. Performance characteristics obtained with the various fuel injector types could not have been predicted from bench-test injector spray characteristics. The effect of the number of operating fuel injectors on performance and emissions is also presented.

81A38062*# ISSUE 17 PAGE 3002 CATEGORY 71
81/05/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Comparison of predicted engine core noise with proposed FAA helicopter noise certification requirements

AUTH: A/VON GLAHN, U.; B/GROESBECK, D. PAA: B/(NASA, Lewis Research Center, Cleveland, OH)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

Acoustical Society of America, Meeting, 101st, Ottawa, Canada, May 18-22, 1981, Paper. 17 p.

MAJS: /*CERTIFICATION/*ENGINE NOISE/*HELICOPTER ENGINES/* NOISE INTENSITY/*NOISE PREDICTION (AIRCRAFT)

MINS: / NOISE POLLUTION/ NOISE REDUCTION/ NOISE SPECTRA

ABA: (Author)

ABS: Calculated engine core noise levels, based on NASA-Lewis prediction procedures, for five representative helicopter engines are compared with measured total helicopter noise levels and proposed FAA helicopter noise certification requirements. Comparisons are made for level flyover and approach procedures. The measured noise levels are generally significantly greater than those predicted for the core noise levels, except for the Sikorsky S-61 and S-64 helicopters. However, the predicted engine core noise levels are generally at or within 3 dB of the proposed FAA noise rules. Consequently, helicopter engine core noise can be a significant contributor to the overall helicopter noise signature and, at this time, will provide a limiting floor to a further decrease in future noise regulations.

81A30003*# ISSUE 12 PAGE 1919 CATEGORY 1 RPT#: ASME PAPER 81-GT-96 81/03/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA research in aeropropulsion

AUTH: A/STEWART, W. L.; B/WEBER, R. J. PAA: B/(NASA, Lewis Research Center, Cleveland, Ohio)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. SAP: MEMBERS, $2.00; NONMEMBERS, $4.00

American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, Houston, Tex., Mar. 9-12, 1981, 11 p.

MAJS: /*AIRCRAFT ENGINES/*GENERAL AVIATION AIRCRAFT/* MILITARY AIRCRAFT/*NASA PROGRAMS/*PROPULSION SYSTEM CONFIGURATIONS/*RESEARCH AND DEVELOPMENT

MINS: / AIR POLLUTION/ NOISE REDUCTION/ TECHNOLOGY UTILIZATION

ABA: L.S.

ABS: NASA research activities in the development of civilian and military aircraft are discussed. The advances made in subsonic and supersonic transports, commuter aircraft, rotorcraft, V/STOL, and high-performance engines are reviewed, and the problems facing general aviation are considered. Comments on some new areas of technology are also presented.

81A19059*# ISSUE 10 PAGE 1297 CATEGORY 3
81/03/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Pneumatic boot for helicopter rotor deicing

AUTH: A/BLAHA, B. J.; B/EVANICH, P. L.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A17/MF A01

In NASA. Langley Research Center The 1980 Aircraft Safety and Operating Probl., Pt. 2 p 425-443 (SEE N81-19056 10-03)

MAJS: /*ANIONS/*DEICING/*DRAG REDUCTION/*HELICOPTERS/* PNEUMATIC EQUIPMENT/*ROTARY WINGS

MINS: / AERODYNAMIC DRAG/ ICE PREVENTION

ABA: E.D.K.

ABS: Pneumatic deicer boots for helicopter rotor blades were tested. The tests were conducted in the 6 by 9 ft icing research tunnel on a stationary section of a UH-1H helicopter main rotor blade. The boots were effective in removing ice and in reducing aerodynamic drag due to ice.

81N22839*# ISSUE 13 PAGE 1827 CATEGORY 71
RPT#: NASA-TM-81739 E-791 81/00/00 19 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Comparison of predicted engine core noise with proposed FAA helicopter noise certification requirements

AUTH: A/VONGLAHN, U.; B/GROESBECK, D. E.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01

Presented at the 101st Meeting of the ASA. Ottawa, Ontario, 18-22 May 1981

MAJS: /*ACOUSTIC MEASUREMENT/*CERTIFICATION/*ENGINE NOISE/* HELICOPTER ENGINES/*NOISE PREDICTION (AIRCRAFT)

MINS: / CH-47 HELICOPTER/ CH-54 HELICOPTER/ COMMERCIAL AIRCRAFT/ CH-6 HELICOPTER/ S-61 HELICOPTER/ UH-1 HELICOPTER

ABA: Author

ABS: Calculated engine core noise levels, based on NASA-Lewis prediction procedures, for five representative helicopter engines are compared with measured total helicopter noise levels and proposed FAA helicopter noise certification requirements. Comparisons are made for level flyover and approach procedures. The measured noise levels are generally

significantly greater than those predicted for the core noise levels, except for Sikorsky S-61 and S-64 helicopters. However, the predicted engine core noise levels are generally at or within 3 db of the proposed FAA noise rules. Consequently, helicopter engine core noise can be a significant contributor to the overall helicopter noise signature and, at this time, will provide a limiting floor to a further decrease in future noise regulations.

81N13056*# ISSUE 4 PAGE 438 CATEGORY 7 RPT#: NASA-TM-81633 E-645 81/00/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA Research in aeropropulsion

AUTH: A/STEWART, W. L.; B/WEBER, R. J.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01

Proposed for presentation at the 26th Ann. Intern. Gas Turbine Conf., Houston, Tex., 8-12 Mar. 1981; sponsored by the ASME

MAJS: /*AERONAUTICAL ENGINEERING/*COMMERCIAL AIRCRAFT/*MILITARY AIRCRAFT/*PROPULSION

MINS: / AIRCRAFT DESIGN/ AIRCRAFT INDUSTRY/ ENGINE DESIGN

ABA: E.D.K.

ABS: Selected examples of recent accomplishments and current activities that are relevant to the principal classes of civil and military vehicles: subsonic transports, commuters, supersonic transports, general aviation, rotorcraft, V/STOL, and high performance. Some instances of emerging technologies with potential high impact on further progress are discussed.

81A18672*# ISSUE 6 PAGE 886 CATEGORY 37 RPT#: ASME PAPER 80-C2/LUB-18 80/08/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Performance of computer-optimized tapered-roller bearings to 2.4 million DN

AUTH: A/PARKER, R. J.; B/PINEL, S. I.; C/SIGNER, H. R. PAA: A/(NASA Lewis Research Center, Cleveland, Ohio); C/(Industrial Tectonics, Inc., Compton, Calif.)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.; Industrial Tectonics, Inc., Compton, Calif. SAP: MEMBERS, $1.50; NONMEMBERS, $3.00

American Society of Mechanical Engineers and American Society of Lubrication Engineers, Century 2 International Lubrication Conference, San Francisco, Calif., Aug. 18-21, 1980. ASME 8 p.

MAJS: /*AIRCRAFT PARTS/*ANGULAR ACCELERATION/*COMPUTERIZED DESIGN/*HELICOPTER PROPELLER DRIVE/*LOAD TESTS/*ROLLER BEARINGS

MINS: / HIGH SPEED/ OPTIMIZATION/ ROTATING SHAFTS/ TEMPERATURE PROFILES/ THRUST LOADS

ABA: A.T.

ABS: The temperature distribution and bearing heat generation of 120.65 mm bore high-speed tapered roller bearings was determined at shaft speeds of 20,000 rpm under simultaneous thrust and radial loads. The temperatures and thermal outputs were computed as functions of shaft speed, loading lubricant flow rates, and lubricant inlet temperatures. Bearing temperatures and heat generation were considerably lower than in standard bearings; cup cooling was effective in lowering cup temperatures to levels of cone temperatures.

80A32887*# ISSUE 13 PAGE 2295 CATEGORY 7 RPT#: AIAA PAPER 80-0914 80/05/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aeropropulsion in year 2000

AUTH: A/WEBER, R. J. PAA: A/(NASA, Lewis Research Center, Cleveland, Ohio)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

American Institute of Aeronautics and Astronautics, International Meeting and Technical Display on Global Technology 2000, Baltimore, Md., May 6-8, 1980. 11 p.

MAJS: /*AIRCRAFT INDUSTRY/*PROPULSION SYSTEM CONFIGURATIONS /*RESEARCH AND DEVELOPMENT/*TECHNOLOGY ASSESSMENT

MINS: / ELECTRONIC CONTROL/ ENGINE DESIGN/ GENERAL AVIATION AIRCRAFT/ HELICOPTER ENGINES/ NOISE REDUCTION/ PROPELLERS/ SUPERSONIC AIRCRAFT/ TURBOPROP ENGINES

ABA: M.E.P.

ABS: The paper demonstrates that many advances can be anticipated in propulsion systems for aircraft in the next 20 years. A survey is presented of probable future engine types, including convertible engines for helicopters, turboprops for fuel efficient airliners, and variable cycle engines for supersonic transports. Also examined is the use of rotary engines in general aviation aircraft. Finally, a review is given of related technology improvements in propellers, materials, noise suppression, and digital electronic controls.

80A42256*# ISSUE 17 PAGE 3194 CATEGORY 37 RPT#: ASME PAPER 80-GT-143 80/03/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Balancing of a power-transmission shaft with the application of axial torque

AUTH: A/ZORZI, E. S.; B/FLEMMING, D. PAA: A/(Mechanical Technology, Inc., Latham, N.Y.); B/(NASA, Lewis Research Center, Cleveland, Ohio)

CORP: Mechanical Technology, Inc., Latham, N. Y.; National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. SAP: MEMBERS, $1.50; NONMEMBERS, $3.00
American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, New Orleans, La., Mar. 10-13, 1980. 5 p. NASA-supported research.
MAJS: /*HELICOPTER TAIL ROTORS/*MECHANICAL DRIVES/*POWER TRANSMISSION/*ROTATING SHAFTS/*TORQUE
MINS: / FLEXIBLE BODIES/ ROTOR SPEED/ TEST FACILITIES/ VIBRATION TESTS
ABA: (Author)
ABS: Evaluation of power transmission shafting for high-speed balancing has shown that when axial torque is applied, the imbalance response is altered. An increase in synchronous excitation always occurs if the axial torque level is altered from the value used during balancing; this was the case even when the shaft was balanced with torque applied. The twisting of the long slender shaft produces a change in the imbalance distribution sufficient to disrupt the balanced state. This paper presents a review of the analytic development of a weighted least squares approach to influence coefficient balancing and a review of experimental results. The analytic approac.. takes advantage of the fact that the past testing has shown that the influence coefficients are not significantly affected by the application of axial torque. The 3.60-m (12-ft) long aluminum shaft, 7.62 cm (3 in.) in diameter was run through the first flexural critical speed at torque levels ranging from zero-torque to 903.8 N-M (8000 lb-in.) in 112.9 N-M (1000 lb-in.) increments. Good comparison was achieved between predicted and experimental results.

B2N23241*# ISSUE 14 PAGE 1903 CATEGORY 5 RPT#: NASA-TM-84207 NAS 1.15:84207 80/00/00 211 PAGES
UNCLASSIFIED DOCUMENT
UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshop. Volume 5: Propulsion Session
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A10/MF A01
Workshop held at Palo Alto, Calif., 3-5 Dec. 1980
MAJS: /*HELICOPTER DESIGN/*HELICOPTER ENGINES/*PROPULSION SYSTEM PERFORMANCE
MINS: / AIRCRAFT STRUCTURES/ AIRFRAME MATERIALS/ COMBUSTION CHAMBERS/ COMPRESSORS/ HELICOPTER PERFORMANCE/ TURBINE ENGINES/ USER REQUIREMENTS
ABA: Author
ABS: The expressed needs and priorities of the civil helicopter users, the existing research efforts, and technology requirements as perceived by leading airframe and engine manufacturers were addressed, compared, and evaluated. Specifically, the observations and conclusions of these areas as they relate to the helicopter propulsion system are reported.

B0N18043*# ISSUE 9 PAGE 1094 CATEGORY 7 RPT#: NASA-TM-81416 E-335 80/00/00 18 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Aeropropulsion in year 2000
AUTH: A/WEBER, R. J.
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01
Proposed for presentation at Global Technol. 2000, the 1980 Intern. Meeting of the Am. Inst. of Aeron. and Astronautics, Baltimore, 5-11 May 1980
MAJS: /*AIRCRAFT ENGINES/*CIVIL AVIATION/*TECHNOLOGICAL FORECASTING
MINS: / HELICOPTERS/ SHORT HAUL AIRCRAFT/ SUPERSONIC AIRCRAFT/ TURBOPROP ENGINES
ABA: R.E.S.
ABS: A sampling of probable future engine types, such as convertible engines for helicopters, turboprops for fuel-conservative airliners, and variable-cycle engines for supersonic transports are presented. Related technology improvements in propellers, materials, noise suppression, etc. are reviewed.

B0N16342*# ISSUE 7 PAGE 860 CATEGORY 37 RPT#: NASA-TM-81414 E-332 80/00/00 29 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Performance of computer-optimized tapered-roller bearings to 2.4 million DN
AUTH: A/PARKER, R. J.; B/PINEL, S. I.; C/SIGNER, H. R.
PAA: B/(Industrial Tectonics, Inc., Compton, Calif.); C/(Industrial Tectonics, Inc., Compton, Calif.)
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A03/MF A01
Proposed for presentation at the Intern. Lubrication Conf., San Francisco, 18-21 Aug. 1980; sponsored by ASME and the Am. Soc. of Lubrication Engr.
MAJS: /*HIGH SPEED/*OPTIMIZATION/*PERFORMANCE TESTS/*ROLLER BEARINGS
MINS: / COOLING/ HELICOPTERS/ LOADS (FORCES)/ LUBRICATION/ TEMPERATURE DISTRIBUTION/ TRANSMISSIONS (MACHINE ELEMENTS)
ABA: K.L.
ABS: The performance of 120.65 mm bore high speed design tapered roller bearings was investigated at shaft speeds to 20,000 rpm under combined thrust and radial

load. The test bearing design was computer optimized for high speed operation. Temperature distribution and bearing heat generation were determined as a function of shaft speed, radial and thrust loads, lubricant flow rates, and lubricant inlet temperature. The roller bearing operated successfully at shaft speeds up to 20,000 rpm under heavy thrust and radial loads. Cup cooling was effective in decreasing the high cup temperatures to levels equal to the cone temperature.

80A13068*# ISSUE 2 PAGE 226 CATEGORY 37
79/11/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA gear research and its probable effect on rotorcraft transmission design

AUTH: A/ZARETSKY, E. V.; B/TOWNSEND, D. P.; C/COY, J. J. PAA: C/(NASA. Lewis Research Center, Cleveland, Ohio)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
American Helicopter Society, Meeting on Helicopter Propulsion Systems, Williamsburg, Va., Nov. 6-8, 1979, Paper. 17 p.

MAJS: /*GEAR TEETH/*GEARS/*HELICOPTER DESIGN/*NASA PROGRAMS /*PRODUCT DEVELOPMENT/*TRANSMISSIONS (MACHINE ELEMENTS)

MINS: / DURABILITY/ DYNAMIC STRUCTURAL ANALYSIS/ GRAPHS (CHARTS)/ HELICOPTER PROPELLER DRIVE/ LUBRICATION/ MECHANICAL DRIVES/ PERFORMANCE TESTS/ SERVICE LIFE

ABA: M.E.P.

ABS: The NASA Lewis Research Center devised a comprehensive gear technology research program beginning in 1969, the results of which are being integrated into the NASA civilian Helicopter Transmission System Technology Program. Attention is given to the results of this gear research and those programs which are presently being undertaken. In addition, research programs studying pitting fatigue, gear steels and processing, life prediction methods, gear design and dynamics, elastohydrodynamic lubrication, lubrication methods and gear noise are presented. Finally, the impact of advanced gear research technology on rotorcraft transmission design is discussed.

79A39805*# ISSUE 16 PAGE 3006 CATEGORY 37
79/06/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Diagnostics of wear in aeronautical systems

AUTH: A/WEDEVEN, L. D. PAA: A/(NASA. Lewis Research Center, Cleveland, Ohio)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
American Chemical Society, State-of-the-Art Symposium on Corrosion and Wear, 15th, Washington, D.C., June 4-6, 1979, Paper. 4 p.

MAJS: /*COST ANALYSIS/*ENGINE MONITORING INSTRUMENTS/* HELICOPTER ENGINES/*LUBRICATING OILS/*TRANSMISSIONS (MACHINE ELEMENTS)/*WEAR TESTS

MINS: / AIRCRAFT MAINTENANCE/ CHIPS (ELECTRONICS)/ CONCENTRATION (COMPOSITION)/ FAILURE MODES/ FILTRATION / FUEL FLOW/ HELICOPTER PROPELLER DRIVE/ PRESSURE EFFECTS/ RADIOACTIVE ISOTOPES/ ROLLER BEARINGS/ TEMPERATURE EFFECTS

ABA: A.T.

ABS: The use of appropriate diagnostic tools for aircraft oil wetted components is reviewed, noting that it can reduce direct operating costs through reduced unscheduled maintenance, particularly in helicopter engine and transmission systems where bearing failures are a significant cost factor. Engine and transmission wear modes are described, and diagnostic methods for oil and wet particle analysis, the spectrometric oil analysis program, chip detectors, ferrography, in-line oil monitor and radioactive isotope tagging are discussed, noting that they are effective over a limited range of particle sizes but compliment each other if used in parallel. Fine filtration can potentially increase time between overhauls, but reduces the effectiveness of conventional oil monitoring techniques so that alternative diagnostic techniques must be used. It is concluded that the development of a diagnostic system should be parallel and integral with the development of a mechanical system.

79A39804*# ISSUE 16 PAGE 2935 CATEGORY 7
79/06/00 63 PAGES UNCLASSIFIED DOCUMENT

UTTL: Materials and structural aspects of advanced gas-turbine helicopter engines

AUTH: A/FRECHE, J. C.; B/ACURIO, J. PAA: A/(NASA. Lewis Research Center, Cleveland, Ohio); B/(U.S. Army. Propulsion Laboratory, Cleveland, Ohio)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
Association Aeronautique et Astronautique de France. International Congress in Aeronautics, Paris, France, June 6-8, 1979, Paper. 63 p.

MAJS: /*ENGINE DESIGN/*GAS TURBINE ENGINES/*HELICOPTER ENGINES

MINS: / COMPONENT RELIABILITY/ COOLING SYSTEMS/ GUIDE VANES/ PREDICTION ANALYSIS TECHNIQUES/ SERVICE LIFE/ STRUCTURAL DESIGN/ TURBINE BLADES

ABA: A.T.

ABS: Advances in materials, coatings, turbine cooling technology, structural and design concepts, and component-life prediction of helicopter gas-turbine-engine components are presented. Stationary parts including the inlet particle

separator, the front frame, rotor tip seals, vanes and combustors and rotating components - compressor blades, disks, and turbine blades - are discussed. Advanced composite materials are considered for the front frame and compressor blades, prealloyed powder superalloys will increase strength and reduce costs of disks, the oxide dispersion strengthened alloys will have 100C higher use temperature in combustors and vanes than conventional superalloys, ceramics will provide the highest use temperature of 1400C for stator vanes and 1370C for turbine blades, and directionally solidified eutectics will afford up to 50C temperature advantage at turbine blade operating conditions. Coatings for surface protection at higher surface temperatures and design trends in turbine cooling technology are discussed. New analytical methods of life prediction such as strain gage partitioning for high temperature prediction, fatigue life, computerized prediction of oxidation resistance, and advanced techniques for estimating coating life are described.

80N15127*# ISSUE 6 PAGE 701 CATEGORY 7 RPT#: NASA-CP-2077 E-9906 79/00/00 426 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Quiet powered-lift propulsion
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A19/MF A01
Conf. held at Cleveland, Ohio, 14-15 Nov. 1978
MAJS: /*C-15 AIRCRAFT/*CONFERENCES/*NASA PROGRAMS/*POWERED LIFT AIRCRAFT/*QUIET ENGINE PROGRAM/*TILT ROTOR AIRCRAFT/*YC-14 AIRCRAFT
MINS: / ARMED FORCES (UNITED STATES)/ PROPULSION SYSTEM PERFORMANCE/ RESEARCH AIRCRAFT/ TECHNOLOGY ASSESSMENT
ABA: R.E.S.
ABS: Latest results of programs exploring new propulsion technology for powered-lift aircraft systems are presented. Topics discussed include results from the 'quiet clean short-haul experimental engine' program and progress reports on the 'quiet short-haul research aircraft' and 'tilt-rotor research aircraft' programs. In addition to these NASA programs, the Air Force AMST YC 14 and YC 15 programs were reviewed.

80N10213*# ISSUE 1 PAGE 28 CATEGORY 7 79/00/00 36 PAGES UNCLASSIFIED DOCUMENT

UTTL: Mechanical components
AUTH: A/ANDERSON, W. J.; B/BILL, R. C.; C/COY, J. J.; D/FLEMING, D. P.
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A20/MF A01
In its Aeropropulsion 1979 p 273-308 (SEE N80-10205 01-07)
MAJS: /*AIRCRAFT ENGINES/*HELICOPTERS/*MECHANICAL DRIVES/*TURBINE ENGINES
MINS: / BEARINGS/ DAMPERS (VALVES)/ GEARS/ ROTARY WINGS/ SEALS (STOPPERS)
ABA: R.E.S.
ABS: Research on bearings, gears, seals, and rotor dynamics (specifically high speed balancing and dampers) is presented. The research pertains to problems in both aircraft turbine engines and helicopter transmissions.

79N33477*# ISSUE 24 PAGE 3215 CATEGORY 37 RPT#: NASA-TM-79292 E-236 79/00/00 19 PAGES
UNCLASSIFIED DOCUMENT

UTTL: NASA gear research and its probable effect on rotorcraft transmission design
AUTH: A/ZARETSKY, E. V.; B/TOWNSEND, D. P.; C/COY, J. J.
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01
Presented at the Meeting on Helicopter Propulsion Systems, Williamsburg, Va., 6-8 Nov. 1979; sponsored by Am. Helicopter Soc.
MAJS: /*MECHANICAL DRIVES/*NASA PROGRAMS/*ROTARY WING AIRCRAFT/*TECHNOLOGY TRANSFER
MINS: / ELASTOHYDRODYNAMICS/ LIFE (DURABILITY)/ LUBRICATION/ NOISE (SOUND)/ STEELS/ STRUCTURAL ENGINEERING
ABA: M.M.M.
ABS: The results of the NASA gear research is reviewed as well as those programs which are presently being undertaken. Research programs studying pitting fatigue, gear steels and processing, life prediction methods, gear design and dynamics, elastohydrodynamic lubrication, lubrication methods and gear noise are presented. The impact of advanced gear research technology on rotorcraft transmission design is discussed.

79N23912*# ISSUE 15 PAGE 1926 CATEGORY 2 RPT#: NASA-CP-2086 FAA-RD-78-109 E-027 79/00/00 147 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Aircraft icing
AUTH: A/BLAHA, B. J. PAT: A/comp.
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A07/MF A01
Workshop held at Cleveland, 19-21 Jul. 1978
MAJS: /*AIRCRAFT HAZARDS/*CONFERENCES/*ICE FORMATION
MINS: / HELICOPTERS/ METEOROLOGY/ SAFETY MANAGEMENT

ANN: The results of a conference on the problems of aircraft icing are reported. For individual titles, see N79-23913 through N79-23919.

79N20008*# ISSUE 11 PAGE 1375 CATEGORY 1 RPT#: NASA-TM-79100 AVRADCOM-TR-79-4 79/00/00 65 PAGES UNCLASSIFIED DOCUMENT

UTTL: Materials and structural aspects of advanced gas-turbine helicopter engines

AUTH: A/FRECHE, J. C.; B/ACURIO, J. PAA: A/(US Army Aviation Res. and Develop. Command, Cleveland)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A04/MF A01

To be presented at the Intern. Congr. in Aeron., Paris, 6-8 Jun. 1979

MAJS: /*ENGINE PARTS/*GAS TURBINE ENGINES/*HELICOPTER DESIGN /*REFRACTORY MATERIALS/*STRUCTURAL DESIGN

MINS: / CERAMICS/ COATING/ COMBUSTION CHAMBERS/ COMPOSITE MATERIALS/ CORROSION/ THERMAL FATIGUE/ TURBINE BLADES

ABA: A.R.H.

ABS: The key to improved helicopter gas turbine engine performance lies in the development of advanced materials and advanced structural and design concepts. The modification of the low temperature components of helicopter engines (such as the inlet particle separator), the introduction of composites for use in the engine front frame, the development of advanced materials with increased use-temperature capability for the engine hot section, can result in improved performance and/or decreased engine maintenance cost. A major emphasis in helicopter engine design is the ability to design to meet a required lifetime. This, in turn, requires that the interrelated aspects of higher operating temperatures and pressures, cooling concepts, and environmental protection schemes be integrated into component design. The major material advances, coatings, and design life-prediction techniques pertinent to helicopter engines are reviewed; the current state-of-the-art is identified; and when appropriate, progress, problems, and future directions are assessed.

79N16849*# ISSUE 8 PAGE 938 CATEGORY 7 RPT#: NASA-TM-79073 E-9890 79/00/00 36 PAGES UNCLASSIFIED DOCUMENT

UTTL: New opportunities for future small civil turbine engines: Overviewing the GATE studies

AUTH: A/STRACK, W. C.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A03/MF A01

Proposed for presentation at the Business and Aircraft Meeting, Wichita, Kans., 3-6 Apr. 1979; sponsored by Soc. of Automotive Engineers, Inc.

MAJS: /*ENGINE DESIGN/*GENERAL AVIATION AIRCRAFT/* TECHNOLOGICAL FORECASTING/*TURBINE ENGINES

MINS: / AIRCRAFT ENGINES/ FIXED WINGS/ HELICOPTER ENGINES/ PERFORMANCE PREDICTION/ PISTON ENGINES/ PRODUCT DEVELOPMENT

ABA: G.G.

ABS: An overview of four independent studies forecasts the potential impact of advanced technology turbine engines in the post 1988 market, identifies important aircraft and missions, desirable engine sizes, engine performance, and cost goals. Parametric evaluations of various engine cycles, configurations, design features, and advanced technology elements defined baseline conceptual engines for each of the important missions identified by the market analysis. Both fixed-wing and helicopter aircraft, and turboshaft, turboprop, and turbofan engines were considered. Sizable performance gains (e.g., 20% SFC decrease), and large engine cost reductions of sufficient magnitude are predicted to challenge the reciprocating engine in the 300-500 SHP class.

79N15958*# ISSUE 7 PAGE 819 CATEGORY 7 RPT#: NASA-TM-79075 E-9892 79/00/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: The gate studies: Assessing the potential of future small general aviation turbine engines

AUTH: A/STRACK, W. C.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01

Presented at the Intern. Ann. Gas Turbine Conf., San Diego, Calif., 11-15 Mar. 1979; sponsored by Am. Soc. of Mechanical Engineers

MAJS: /*GENERAL AVIATION AIRCRAFT/*TURBINE ENGINES

MINS: / AIRFRAMES/ COSTS/ ENGINE PARTS/ HELICOPTERS/ MARKETING/ TURBOFAN ENGINES

ABA: J.A.M.

ABS: Four studies were completed that explore the opportunities for future General Aviation turbine engines (GATE) in the 150-1000 SHP class. These studies forecasted the potential impact of advanced technology turbine engines in the post-1988 market, identified important aircraft and missions, desirable engine sizes, engine performance, and cost goals. Parametric evaluations of various engine cycles, configurations, design features, and advanced technology elements defined baseline conceptual engines for each of the important missions identified by the market analysis. Both fixed-wing and helicopter

aircraft, and turboshaft, turboprop, and turbofan engines were considered. Sizable performance gains (e.g., 20% SFC decrease), and large engine cost reductions of sufficient magnitude to challenge the reciprocating engine in the 300-500 SHP class were predicted.

78N16055*# ISSUE 7 PAGE 844 CATEGORY 7 RPT#: NASA-TM-73831 78/00/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: A review of NASA's propulsion programs for aviation
AUTH: A/STEWART, W. L.; B/JOHNSON, H. W.; C/WEBER, R. J.
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A02/MF A01
Presented at the 16th Aerospace Sci. Meeting, Huntsville, Ala., 16-18 Jan.; sponsored by AIAA
MAJS: /*CIVIL AVIATION/*JET PROPULSION/*NASA PROGRAMS/* VARIABLE CYCLE ENGINES
MINS: / ENERGY CONSERVATION/ FUEL CONSUMPTION/ SUPERSONIC AIRCRAFT/ TURBOFAN ENGINES
ABA: Author
ABS: A review of five NASA engine-oriented propulsion programs of major importance to civil aviation are presented and discussed. Included are programs directed at exploring propulsion system concepts for (1) energy conservation subsonic aircraft (improved current turbofans, advanced turbofans, and advanced turboprops); (2) supersonic cruise aircraft (variable cycle engines); (3) general aviation aircraft (improved reciprocating engines and small gas turbines); (4) powered lift aircraft (advanced turbofans); and (5) advanced rotorcraft.

77N33160*# ISSUE 24 PAGE 3174 CATEGORY 7 RPT#: NASA-TM-X-73668 E-9091-1 77/09/29 42 PAGES UNCLASSIFIED DOCUMENT

UTTL: Steady-state unbalance response of a three-disk flexible rotor on flexible, damped supports
AUTH: A/CUNNINGHAM, R. E.
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A03/MF A01
Presented at the Vibrations Conf., Chicago, 26-29 Sep. 1977; sponsored by ASME
MAJS: /*BALL BEARINGS/*DAMPERS (VALVES)/*ROTORS/*STEADY STATE/*VIBRATION ISOLATORS
MINS: / DAMPING/ FUEL CONSUMPTION/ HELICOPTERS/ STRUCTURAL VIBRATION/ TURBOSHAFTS
ABA: Author
ABS: Experimental data are presented for the unbalance response of a flexible, ball bearing supported rotor to speeds above the third lateral bending critical. Values of squeeze film damping coefficients obtained from measured data are compared to theoretical values obtained from short bearing approximation over a frequency range from 5000 to 31 000 cycles/min. Experimental response for an undamped rotor is compared to that of one having oil squeeze film dampers at the bearings. Unbalance applied varied from 0.62 to 15.1 gm-cm.

77N22106*# ISSUE 13 PAGE 1680 CATEGORY 7 RPT#: NASA-TM-X-3524 E-9026 77/05/00 35 PAGES UNCLASSIFIED DOCUMENT

UTTL: Dynamics of high-bypass-engine thrust reversal using a variable-pitch fan
AUTH: A/SCHAEFER, J. W.; B/SAGERSER, D. R.; C/STAKOLICH, E. G.
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A03/MF A01
Washington
MAJS: /*BYPASSES/*HELICOPTER PROPELLER DRIVE/*THRUST REVERSAL/*VARIABLE PITCH PROPELLERS
MINS: / DYNAMIC TESTS/ PITCH (INCLINATION)/ PROPULSION SYSTEM CONFIGURATIONS
ABA: Author
ABS: The test program demonstrated that successful and rapid forward-to reverse-thrust transients can be performed without any significant engine operational limitations for fan blade pitch changes through either feather pitch or flat pitch. For through-feather-pitch operation with a flight inlet, fan stall problems were encountered, and a fan blade overshoot technique was used to establish reverse thrust.

77N33517*# ISSUE 24 PAGE 3224 CATEGORY 37 RPT#: NASA-TM-X-73673 E-8825 77/00/00 29 PAGES UNCLASSIFIED DOCUMENT

UTTL: Lubrication of high-speed, large bore tapered-roller bearings
AUTH: A/PARKER, R. J.; B/SIGNER, H. R. PAA: B/(Industrial Tectonics, Inc.)
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A03/MF A01
Presented at the Joint Lubrication Conf., Kansas City, 3-5 Oct. 1977; sponsored by ASLE and ASME
MAJS: /*BEARINGS/*LUBRICATION/*LUBRICATION SYSTEMS/*ROLLER BEARINGS
MINS: / HELICOPTERS/ LUBRICANTS/ TRANSMISSIONS (MACHINE ELEMENTS)
ABA: Author

ABS: The performance of 120.65-mm- (4.75-in.-) bore tapered-roller bearings was investigated at shaft speeds up to 15,000 rpm (18,000 DN). Temperature distribution and bearing heat generation were determined as a function of shaft speed, radial and thrust loads, lubricant flow rate, and lubricant inlet temperature. Lubricant was supplied either by jets or by a combination of holes through the cone directly to the cone-rib contact and jets at the roller small-end side. Cone-rib lubrication significantly improved high-speed tapered-roller bearing performance, yielding lower cone-face temperatures and lower power loss and allowing lower lubricant flow rates for a given speed condition. Bearing temperatures increased with increased shaft speed and decreased with increased lubricant flow rate. Bearing power loss increased with increased shaft speed and increased lubricant flow rate.

76A43148*# ISSUE 22 PAGE 3465 CATEGORY 37
76/05/00 35 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of ball and roller bearings restored by grinding

AUTH: A/PARKER, R. J.; B/ZARETSKY, E. V.; C/CHEN, S. M.
PAA: B/(NASA. Lewis Research Center, Cleveland, Ohio); C/(NASA. Lewis Research Center, Cleveland, Ohio; U.S. Army, Aviations Systems Command, St. Louis, Mo.)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.; Army Aviation Systems Command, St. Louis, Mo.; National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

U.S. Army and NASA Lewis Research Center, Bearing Restoration by Grinding Seminar, St. Louis, Mo., May 20, 21, 1976, Paper. 35 p.

MAJS: /*BALL BEARINGS/*ENGINE PARTS/*FATIGUE TESTS/*MECHANICAL DRIVES/*METAL GRINDING/*ROLLER BEARINGS/*TURBINE ENGINES

MINS: / BOUNDARY LUBRICATION/ ELASTOHYDRODYNAMICS/ FAILURE ANALYSIS/ HELICOPTER ENGINES/ INSPECTION/ QUALITY CONTROL/ RESTORATION/ SHEAR STRESS/ SURFACE FINISHING/ UH-1 HELICOPTER

ABA: (Author)

ABS: A joint program was undertaken to restore by grinding these rolling-element bearings which are currently being discarded at aircraft engine and transmission overhaul. Three bearing types were selected from the UH-1 helicopter engine (T-53) and transmission for the pilot program. Groups of each of these bearings were visually and dimensionally inspected for suitability for restoration. A total of 250 bearings were restored by grinding. Of this number, 30 bearings from each type were endurance tested to a TBO of 1600 hours. No bearing failures occurred related to the restoration by grinding process. The two bearing failures which occurred were due to defective rolling elements and were typical of those which may occur in new bearings. The restorable component yield to the three groups was in excess of 90 percent.

76N23582*# ISSUE 14 PAGE 1803 CATEGORY 37
RPT#: NASA-TM-X-71892 E-8678 76/05/00 19 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Oil-air mist lubrication as an emergency system and as a primary lubrication system --- for helicopter engines

AUTH: A/LOOMIS, W. R.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC $3.50

MAJS: /*BEARINGS/*HELICOPTER ENGINES/*LUBRICATION SYSTEMS

MINS: / AIR COOLING/ AIRCRAFT SAFETY/ EMERGENCIES/ HEAT GENERATION/ MIST/ VORTEX GENERATORS

ABA: Author

ABS: The feasibility of an emergency aspirator once-through lubrication system was demonstrated as a viable survivability concept for Army helicopter mainshaft engine bearings for periods as long as 30 minutes. It was also shown in an experimental study using a 46-mm bore bearing test machine that an oil-air mist once-through system with auxiliary air cooling is an effective primary lubrication system at speeds up to 2,500,000 DN for extended operating periods of at least 50 hours.

76N16065*# ISSUE 7 PAGE 802 CATEGORY 5 RPT#:
NASA-TM-X-71867 E-8633 76/01/00 35 PAGES
UNCLASSIFIED DOCUMENT

UTTL: OH-58 helicopter transmission failure analysis

AUTH: A/TOWNSEND, D. P.; B/COY, J. J.; C/HATVANI, B. R.
PAA: B/(Army Air Mobility Res. and Develop. Lab., Cleveland)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC $4.00

MAJS: /*FAILURE ANALYSIS/*HELICOPTER PROPELLER DRIVE

MINS: / GAS COOLING/ GEARS/ HELICOPTER PERFORMANCE/ LIQUID COOLING/ LUBRICATING OILS/ TORSIONAL STRESS

ABA: Author

ABS: The OH-58 main transmission gearbox was run at varying output torques, speeds, and oil cooling rates. The gearbox was subsequently run to destruction by draining the oil from the gearbox while operating at a speed of 6200 revs per minute and 36,000 inch-pounds output torque. Primary cause of gearbox failure was

overheating and melting of the planet bearing aluminum cages. Complete failure of the gearbox occurred in 28 1/2 minutes after the oil pressure dropped to zero. The alternating and maximum stresses in the gearbox top case were approximately 10 percent of the endurance limit for the material. Deflection of the bevel gear at 67000 inch-pounds output torque indicate a marginal stiffness for the bevel gear supporting system.

76A14872*# ISSUE 4 PAGE 519 CATEGORY 37 RPT#: ASME PAPER 75-LUB-20 75/10/00 8 PAGES
UNCLASSIFIED DOCUMENT

UTTL: A life study of ausforged, standard forged, and standard machined AISI M-50 spur gears

AUTH: A/TOWNSEND, D. P.; B/ZARETSKY, E. V.; C/BAMBERGER, E. N. PAA: B/(NASA, Lewis Research Center, Cleveland, Ohio); C/(General Electric Co., Evendale, Ohio)

CORP: General Electric Co., Evendale, Ohio.; National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. SAP: MEMBERS, $1.50; NONMEMBERS, $3.00
American Society of Mechanical Engineers and American Society of Lubrication Engineers, Joint Lubrication Conference, Miami Beach, Fla., Oct. 21-23, 1975, ASME 8 p.

MAJS: /*AIRCRAFT PARTS/*FATIGUE LIFE/*GEAR TEETH/*METAL WORKING/*PERFORMANCE TESTS/*SERVICE LIFE

MINS: / AUSFORMING/ FORGING/ HELICOPTERS/ METAL FATIGUE/ PHOTOMICROGRAPHY/ STEEL STRUCTURES

ABA: (Author)

ABS: Tests were conducted at 350 K with three groups of 8.9 cm pitch diameter spur gears made of vacuum-induction melted (VIM), vacuum-arc remelted (VAR), AISI M-50 steel and one group of vacuum-arc remelted (VAR) AISI 9310 steel. The pitting fatigue life of the standard forged and ausforged gears was approximately five times that of the VAR AISI 9310 gears and ten times that of the bending fatigue life of the standard machined VIM-VAR AISI M-50 gears run under identical conditions. There was a slight decrease in the 10-percent life of the ausforged gears from that for the standard forged gears. However, the difference is not statistically significant. The standard machined gears failed primarily by gear tooth fracture while the forged and ausforged VIM-VAR AISI M-50 and the VAR AISI 9310 gears failed primarily by surface pitting fatigue. The ausforged gears had a slightly greater tendency to fail by tooth fracture than the standard forged gears.

75N33055*# ISSUE 24 PAGE 3003 CATEGORY 7 RPT#: NASA-TM-X-71806 E-8496 75/09/00 20 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Development of circumferential seal for helicopter transmissions: Results of bench and flight tests

AUTH: A/STROM, T. N.; B/LUDWIG, L. P.

CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC $3.25

MAJS: /*FLIGHT TESTS/*HELICOPTER ENGINES/*LUBRICANTS/*O RING SEALS/*SHAFTS (MACHINE ELEMENTS)

MINS: / FLIGHT SIMULATION/ PERFORMANCE PREDICTION

ABA: Author

ABS: A modified circumferential segmented ring seal was designed for direct replacement of a helicopter transmission elastomeric lip seal operating on a shaft diameter of 13.91 centimeters (5.481 in.) at sliding velocities to 52.48 m/sec (10 330 ft/min). The modifications involved the garter spring tension, shaft roundness, seal housing flatness, and pumping grooves to inhibit leakage. Operation of the seals in bench tests under simulated helicopter transmission conditions revealed that the seal leakage rate was within acceptable limits and that the wear rate was negligible. The low leakage and wear rates were confirmed in flight tests of 600 and 175 hours (sliding speed, 48.11 m/sec (9470 ft/min)). An additional 200 hours of air worthiness qualification testing (aircraft tie down) demonstrated that the seal can operate at the advanced sliding conditions of 52.48 m/sec (10 330 ft/min).

75N25094*# ISSUE 16 PAGE 1961 CATEGORY 34 RPT#: NASA-TM-X-3242 E-8238 75/06/00 14 PAGES
UNCLASSIFIED DOCUMENT

UTTL: External fins and ejector action for reducing the infrared emission of engine exhaust ducting

AUTH: A/VANFOSSEN, G. J., JR.

CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC $3.25
Washington

MAJS: /*EXHAUST SYSTEMS/*FINS/*INFRARED SPECTRA/*SPECTRAL EMISSION

MINS: / EJECTORS/ FEASIBILITY ANALYSIS/ HELICOPTERS/ NUMERICAL ANALYSIS/ TEMPERATURE GRADIENTS

ABA: Author

ABS: An analytical investigation was conducted to determine the feasibility of using external fins and ejector action on the exhaust ducting of a helicopter to reduce the infrared emission of the aircraft. Temperatures were calculated for both circular disk fins and pin fins. Results show that combining ejector

action with fins can lower the metal temperature to acceptable levels at least for high flight speeds.

74N25536*# ISSUE 15 PAGE 1740 CATEGORY 1 RPT#: NASA-TM-X-3073 E-7870 74/06/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Water table tests of proposed heat transfer tunnels for small turbine vanes

AUTH: A/MEITNER, P. L.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.; Army Air Mobility Research and Development Lab., Cleveland, Ohio.
AVAIL.NTIS SAP: HC $3.00
Wpshington Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland

MAJS: /*HEAT TRANSFER/*HELICOPTER ENGINES/*HYDRAULIC TEST TUNNELS/*TRANSFER TUNNELS/*TURBINE BLADES

MINS: / PERFORMANCE TESTS/ TEST FACILITIES/ THERMODYNAMIC PROPERTIES

ABA: Author

ABS: Water-table flow tests were conducted for proposed heat-transfer tunnels which were designed to provide uniform flow into their respective test sections of a single core engine turbine vane and a full annular ring of helicopter turbine vanes. Water-table tests were also performed for the single-vane test section of the core engine tunnel. The flow in the heat-transfer tunnels was shown to be acceptable.

74N19405*# ISSUE 10 PAGE 1211 CATEGORY 28 RPT#: NASA-TM-X-71517 E-7908 74/02/00 29 PAGES UNCLASSIFIED DOCUMENT

UTTL: A simplified life-cycle cost comparison of various engines for small helicopter use

AUTH: A/CIVINSKAS, K. C.; B/FISHBACH, L. H.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.; Army Air Mobility Research and Development Lab., Cleveland, Ohio.
AVAIL.NTIS SAP: HC $4.50
Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland, Ohio

MAJS: /*COST ANALYSIS/*HELICOPTER ENGINES/*JET ENGINES/*PISTON ENGINES/*PROPULSION SYSTEM PERFORMANCE

MINS: / COST EFFECTIVENESS/ ENGINE TESTS/ FUEL CONSUMPTION

ABA: Author

ABS: A ten-year, life-cycle cost comparison is made of the following engines for small helicopter use: (1) simple turboshaft; (2) regenerative turboshaft; (3) compression-ignition reciprocator; (4) spark-ignited rotary; and (5) spark-ignited reciprocator. Based on a simplified analysis and somewhat approximate data, the simple turboshaft engine apparently has the lowest costs for mission times up to just under 2 hours. At 2 hours and above, the regenerative turboshaft appears promising. The reciprocating and rotary engines are less attractive, requiring from 10 percent to 80 percent more aircraft to have the same total payload capability as a given number of turbine powered craft. A nomogram was developed for estimating total costs of engines not covered in this study.

73N21069*# ISSUE 12 PAGE 1364 CATEGORY 2 RPT#: NASA-TM-X-68215 73/05/11 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Elastohydrodynamic principles applied to the design of helicopter components

UNOC: Analysis of parameters and elastohydrodynamic principles affecting lubrication of transmission components with application to helicopter mechanical drive systems

AUTH: A/TOWNSEND, D. P.

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC $3.00
Presented at 29th Natl. Forum of the Am. Helicopter Soc., Washington, D. C., 10-11 May 1973

MAJS: /*ELASTOHYDRODYNAMICS/*HELICOPTER PROPELLER DRIVE/*LUBRICATION/*MECHANICAL DRIVES

MINS: / ANTIFRICTION BEARINGS/ RELIABILITY ANALYSIS/ SURFACE PROPERTIES/ TEMPERATURE EFFECTS

ABA: Author

ABS: Elastohydrodyhamic principles affecting the lubrication of transmission components are presented and discussed. Surface temperature of the transmission bearings and gears affect elastohydrodynamic film thickness. Traction forces and sliding as well as the inlet temperature determine surface temperatures. High contact ratio gears cause increased sliding and may run at higher surface temperatures. Component life is a function of the ratio of elastohydrodynamic film thickness to composite surface roughness. Lubricant starvation reduces elastohydrodynamic film thickness and increases surface temperatures. Methods are presented which allow for the application of elastohydrodynamic principles to transmission design in order to increase system life and reliability.

74N11204*# ISSUE 2 PAGE 159 CATEGORY 13 RPT#: NASA-TM-X-71481 73/00/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Airborne profiling of ice thickness using a short pulse radar

AUTH: A/VICKERS, R. S.; B/HEIGHWAY, J. E.; C/GEDNEY, R.

PAA: A/(Colo. State Univ.)

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC $3.00
Presented at Advanced Concepts and Techniques in the Study of Snow and Ice Resources, Monterey, Calif., 2-6 Dec. 1973
MAJS: /*AIRBORNE EQUIPMENT/*ICE MAPPING/*PULSE RADAR
MINS: / GROUND TRUTH/ HELICOPTERS/ LAKE ICE/ RIVERS
ABA: Autnor
ABS: The acquisition and interpretation of ice thickness data from a mobile platform has for some time been a goal of the remote sensing community. Such data, once obtainable, is of value in monitoring the changes in ice thickness over large areas, and in mapping the potential hazards to traffic in shipping lanes. Measurements made from a helicopter-borne ice thickness profiler of ice in Lake Superior, Lake St. Clair and the St. Clair river as part of NASA's program to develop an ice information system are described. The profiler described is a high resolution, non-imaging, short pulse radar, operating at a carrier frequency of 2.7 GHz. The system can resolve reflective surfaces separated by as little as 10 cm, and permits measurement of the distance between resolvable surfaces with an accuracy of about 1 cm. Data samples are given for measurements both in a static (helicopter hovering), and a traverse mode. Ground truth measurements taken by an ice auger team traveling with the helicopter are compared with the remotely sensed data and the accuracy of the profiler is discussed based on these measurements.

72N26504*# ISSUE 19 PAGE 2570 CATEGORY 15
RPT#: NASA-TM-X-68117 E-7050 72/00/00 13 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Design analysis for a nutating plate drive 4
UNOC: Design analysis of nutating plate drive for 2500 horse power helicopter rotor gearbox
AUTH: A/LOEWENTHAL, S. H.; B/TOWNSEND, D. P.
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC $3.00
Prosposed for presentation at Mech. Conf. and Intern. Symp. on Gearing and transmissions, San Francisco, 8-12 Oct. 1972; sponsored by ASME and AM. Gear MFR. Assoc.
MAJS: /*HELICOPTERS/*MECHANICAL DRIVES/*NUTATION DAMPERS/* ROTARY WINGS/*SYSTEMS ANALYSIS
MINS: / PERFORMANCE TESTS/ ROLLER BEARINGS/ SYSTEM EFFECTIVENESS
ABA: Author
ABS: A simplified design analysis was conducted on a nutating plate type drive system for a 2500 horsepower helicopter main rotor gear box. A drive system that split the output torque evenly between two nutating plates for the purpose of reducing the load on each nutating plate was analyzed. Needle bearings were used on the nutating plate pins. The results of the analysis indicate that the required load capacity of the pin bearings and the speed of the nutating plate bearings were beyond the state-of-the-art capacity of rolling-element bearings. The analysis further indicates that the nutating plate drive is less efficient, and results in a higher weight per horsepower than a conventional planetary helicopter transmission with similar design specifications.

PRINT 32/2/1-26 . TERMINAL=20

82N21138* ISSUE 12 PAGE 1601 CATEGORY 1 RPT#: NASA-SP-7037(145) NAS 1.21:7037(145) 82/02/00 100 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aeronautical engineering. A continuing bibliography with indexes

CORP: National Aeronautics and Space Administration. Washington, D. C. AVAIL.NTIS SAP: HC $5.00

MAJS: /*AERODYNAMICS/*AERONAUTICAL ENGINEERING/* BIBLIOGRAPHIES

MINS: / AIRBORNE/SPACEBORNE COMPUTERS/ AIRCRAFT DESIGN/ AIRCRAFT NOISE/ AIRPORTS/ AVIONICS/ COMPOSITE STRUCTURES/ COMPUTATIONAL FLUID DYNAMICS/ COMPUTER PROGRAMS/ FLIGHT CONTROL/ HELICOPTERS/ MAGNETS/ SPACE SHUTTLES

ABA: R.J.F.

ABS: This bibliography lists 326 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1982. Topics on aeronautical engineering and aerodynamics such as flight control systems, avionics, computer programs, computational fluid dynamics and composite structures are covered.

82N20175*# ISSUE 11 PAGE 1464 CATEGORY 5 RPT#: NASA-TM-76671 NAS 1.15:76671 CNT#: NASW-3542 82/01/00 11 PAGES UNCLASSIFIED DOCUMENT

Translation was announced as N81-26131

UTTL: Fatigue analysis of composite materials using the fail-safe concept

AUTH: A/STIEVENARD, G.

CORP: National Aeronautics and Space Administration. Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01 Transl. by SCITRAN, Santa Barbara, Calif. Transl. into ENGLISH of AGARD Rept. AGARD-CP-297 (France), Mar. 1981 p 1-15

MAJS: /*AIRCRAFT STRUCTURES/*COMPONENT RELIABILITY/* COMPOSITE STRUCTURES/*FAIL-SAFE SYSTEMS/*FAILURE ANALYSIS/*FATIGUE LIFE/*HELICOPTER DESIGN/*HELICOPTERS

MINS: / COSTS/ CRACK PROPAGATION/ CRACKS/ PROBABILITY THEORY / RISK/ ROTORS/ RUPTURING/ VIBRATIONAL STRESS

ABA: R.J.F.

ABS: If R1 is the probability of having a crack on a flight component and R2 is the probability of seeing this crack propagate between two scheduled inspections, the global failure regulation states that this product must not exceed 0.0000001.

81N73353* CATEGORY 5 RPT#: NASA-NEWS-RELEASE-81-38 P81-10038 81/03/16 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA Lewis working on de-icing for small planes, copters

AUTH: A/ATCHISON, K.

CORP: National Aeronautics and Space Administration, Washington, D. C. SAP: Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240

MAJS: /*AIRCRAFT SAFETY/*DEICING/*HELICOPTERS/*LIGHT AIRCRAFT/*NASA PROGRAMS

MINS: / ANTIICING ADDITIVES/ ELECTRIC WIRE/ HEATING/ ROTARY WINGS

81N20031*# ISSUE 11 PAGE 1432 CATEGORY 2 RPT#: NASA-TM-75907 CNT#: NASW-3199 81/01/00 15 PAGES UNCLASSIFIED DOCUMENT

Original language document announced as A80-48126

UTTL: The elaboration of a new family of helicopter blade profiles

AUTH: A/THIBERT, J. J.

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by ONERA Transl. into ENGLISH from L'Aeron. et l'Astron., (France), no. 81, Feb. 1981 p 13-19

MAJS: /*AERODYNAMIC CHARACTERISTICS/*ROTARY WINGS/*WIND TUNNEL TESTS/*WING PROFILES

MINS: / FLIGHT TESTS/ HELICOPTER DESIGN/ HELICOPTER PERFORMANCE

ABA: J.D.H.

ABS: An airfoil family of helicopter rotor blades was designed. Three airfoils with thickness to chord ratios of 12, 9, and 7% were designed. Their improved performance in two dimensional rotor mockup wind tunnel tests led to testing of the tapered blades on four bladed rotors in a wind tunnel and flight tests on the Dauphin series of helicopters, confirming the expected gains.

81N19139*# ISSUE 10 PAGE 1309 CATEGORY 9 RPT#: NASA-TM-75887 CNT#: NASW-3199 81/01/00 21 PAGES UNCLASSIFIED DOCUMENT

Original language document was announced as A80-36845

UTTL: First results obtained by the AMD-BA Company from the rotary assembly of the AMF Lille

AUTH: A/COUEDOR, C.

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Colloq. held in Lille, France, 13-15 Nov.

1979 Transl. into ENGLISH of conf. paper presented at the 16th Colloq. d'Aerodyn. Appl. p 1-21

MAJS: /*AERODYNAMIC CHARACTERISTICS/*FLIGHT TESTS/*ROTARY WING AIRCRAFT

MINS: / AERODYNAMIC COEFFICIENTS/ LOW PASS FILTERS/ PRESSURE GRADIENTS

ABA: R.C.T.

ABS: Efforts were made to extend flight range of combat airplanes to high incidences. The static and dynamic results obtained on a modern combat airplane with data wings are presented.

82N19173*# ISSUE 10 PAGE 1318 CATEGORY 2 RPT#: NASA-TM-84146 80/12/05 149 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshops. Volume 4: Flight Control Avionics Systems and Human Factors

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A07/MF A01 Workshop held at Palo Alto, Calif., 2-5 Dec. 1980

MAJS: /*HELICOPTER DESIGN/*HELICOPTER ENGINES/*HELICOPTER PERFORMANCE/*HELICOPTERS/*SHORT TAKEOFF AIRCRAFT/* TECHNOLOGY ASSESSMENT/*USER REQUIREMENTS

MINS: / CONFERENCES/ PAPERS/ PROCEEDINGS/ RESEARCH/ ROTARY WING AIRCRAFT/ TILTING ROTORS

ABA: L.F.M.

ABS: Helicopter user needs, technology requirements and status, and proposed research and development action are summarized. It is divided into three sections: flight dynamics and control; all weather operations; and human factors.

82N19171*# ISSUE 10 PAGE 1317 CATEGORY 2 RPT#: NASA-TM-84148 80/12/05 111 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshops. Volume 2: Operators' Views

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A06/MF A01 Workshop held at Palo Alto, Calif., 2-5 Dec. 1980

MAJS: /*HELICOPTER DESIGN/*HELICOPTER ENGINES/*HELICOPTER PERFORMANCE/*HELICOPTERS/*SHORT TAKEOFF AIRCRAFT/* TECHNOLOGY ASSESSMENT/*USER REQUIREMENTS

MINS: / CONFERENCES/ PAPERS/ PROCEEDINGS/ RESEARCH/ ROTARY WING AIRCRAFT/ TILTING ROTORS

ABA: L.F.M.

ABS: A special panel of helicopter users give presentations in 12 basic areas of helicopter applications. Development of the helicopter and the needs for future growth are discussed.

82N19170*# ISSUE 10 PAGE 1317 CATEGORY 2 RPT#: NASA-TM-84149 80/12/05 115 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshops. Volume 1: Executive Summary

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A06/MF A01 Workshop held at Palo Alto, Calif., 3-5 Dec. 1980

MAJS: /*HELICOPTER DESIGN/*HELICOPTER ENGINES/*HELICOPTER PERFORMANCE/*HELICOPTERS/*SHORT TAKEOFF AIRCRAFT/* TECHNOLOGY ASSESSMENT/*USER REQUIREMENTS

MINS: / CONFERENCES/ PAPERS/ PROCEEDINGS/ RESEARCH/ ROTARY WING AIRCRAFT/ TILTING ROTORS

ABA: L.F.M.

ABS: This presentation provides an overview of the NASA Rotorcraft Program as an introduction to the technical sessions of the Advanced Rotorcraft Technology Workshop. It deals with the basis for NASA's increasing emphasis on rotorcraft technology, NASA's research capabilities, recent program planning efforts, highlights of its 10-year plan and future directions and opportunities.

82N19172*# ISSUE 10 PAGE 1317 CATEGORY 2 RPT#: NASA-TM-84147 80/12/04 285 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshops. Volume 3: Aerodynamics and Structures Session

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A13/MF A01 Workshop held at Palo Alto, Calif., 2-5 Dec. 1980

MAJS: /*AERODYNAMIC CHARACTERISTICS/*CONFERENCES/* HELICOPTERS/*ROTOR AERODYNAMICS/*ROTOR SYSTEMS RESEARCH AIRCRAFT/*TILT ROTOR AIRCRAFT

MINS: / AERODYNAMIC LOADS/ AERODYNAMICS/ COMPOSITE STRUCTURES/ COMPUTATIONAL FLUID DYNAMICS/ FUSELAGES/ ROTARY WINGS/ STRUCTURAL VIBRATION/ VORTEX ALLEVIATION / WING TIP VORTICES

ABA: R.J.F.

ABS: Advanced rotorcraft technology and tilt rotor aircraft were discussed. Rotorcraft performance, acoustics, and vibrations were discussed, as was the use of composite materials in rotorcraft structures. Rotorcraft aerodynamics, specifically the aerodynamic phenomena of a rotating and the aerodynamics of fuselages, was discussed.

B1N22688*# ISSUE 13 PAGE 1806 CATEGORY 52
RPT#: NASA-TM-75791 AGARD-CP-225 CNT#: NASW-3199
80/06/00 8 PAGES UNCLASSIFIED DOCUMENT
Translation was announced as N79-19634

UTTL: Radiological examination of the spine and fitness for work as a helicopter pilot
AUTH: A/DELAHAYE, R. P.; B/AUFFRET, R.; C/METGES, P. J.
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01
Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Aerospace Research and Development, Paris Transl. into ENGLISH of ""Examen Radiologique du Rechis et Aptitude a l'Emploi de Pilot d'Helicoptere'' Rept. AGARD-CP-255, Paris, Dec. 1978 p 56-1-56-7
MAJS: /*AIRCRAFT PILOTS/*FLIGHT FITNESS/*PHYSICAL EXAMINATIONS/*RADIOLOGY/*SPINE
MINS: / MUSCULOSKELETAL SYSTEM/ QUALIFICATIONS/ VERTEBRAE/ X RAY ANALYSIS
ABA: Author
ABS: On the matter of spinal fitness for piloting, standards are proposed that suit the critical spinal segments proper to different jobs. Involved here are primarily pilots of combat airplanes and of helicopters. Fitness for one of these does not necessarily mean fitness for the other.

80N29133*# ISSUE 19 PAGE 2627 CATEGORY 71
RPT#: NASA-TM-75832 CNT#: NASW-3199 80/06/00 17 PAGES UNCLASSIFIED DOCUMENT
Original language document was announced as A80-21962

UTTL: Research: Aircraft noise reduction in France
AUTH: A/PIANKO, M.
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01
Transl. by Kanner (Leo) Associates, Redwood City, Calif. Transl. into ENGLISH from Voies-Avaition Civile (France), 1979 p 31-34
MAJS: /*AERODYNAMIC NOISE/*AIRCRAFT NOISE/*NOISE POLLUTION/*NOISE REDUCTION
MINS: / ACOUSTICS/ ENVIRONMENT POLLUTION/ NOISE MEASUREMENT/ SUPERSONIC AIRCRAFT
ABA: L.F.M.
ABS: In 1967 the French aeronautics industry began extensive research in the field of noise abatement. Substantial progress is shown for both supersonic and subsonic transports as well as for helicopters.

80N28043*# ISSUE 18 PAGE 2472 CATEGORY 52
RPT#: NASA-TM-75792 CNT#: NASW-3199 80/06/00 19 PAGES UNCLASSIFIED DOCUMENT
Translation was announced as N79-19656

UTTL: Vertebral pain in helicopter pilots
AUTH: A/AUFFRET, R.; B/DELAHAYE, R. P.; C/METGES, P. J.; D/VICENS
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01
Transl. by Kanner (Leo) Associates, Redwood City, Calif. transl. into ENGLISH of ""Les Algies Vertebrales des Pilotes d'Helicopteres'', Rept. AGARD-CP-255, AGARD, Paris, Dec.1978 7 p
MAJS: /*AIRCRAFT PILOTS/*CLINICAL MEDICINE/*HELICOPTERS/*PATHOLOGY/*VERTEBRAL COLUMN
MINS: / CAUSES/ DISEASES/ PATHOLOGICAL EFFECTS/ PHYSIOLOGICAL EFFECTS/ SIGNS AND SYMPTOMS
ABA: R.E.S.
ABS: Pathological forms of spinal pain engendered by piloting helicopters were clinically studied. Lumbalgia and pathology of the dorsal and cervical spine are discussed along with their clinical and radiological signs and origins.

80A39290* ISSUE 16 PAGE 2903 CATEGORY 3
79/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: A summary of lighter-than-air technology development and applications in the United States
AUTH: A/MAYER, N. J. PAA: A/(NASA, Washington, D.C.)
CORP: National Aeronautics and Space Administration, Washington, D. C.
In: Economics and technology of airships; International Symposium, Paris, France, March 28-30, 1979, Proceedings. Volume 1. (A80-39281 16-01) Paris, Association d'Etude et de Recherche sur les Aerocnefs Alleges, 1979, p. 169-183.
MAJS: /*AIR TRANSPORTATION/*AIRSHIPS/*TECHNOLOGY ASSESSMENT
MINS: / AIR CARGO/ CARGO AIRCRAFT/ HEAVY LIFT HELICOPTERS/ SURVEILLANCE/ UNITED STATES OF AMERICA/ VERTICAL TAKEOFF
ABA: B.J.
ABS: Recent studies indicate the promise of advanced LTA vehicles that can carry heavy loads and be capable of vertical takeoff and landing. Such airships may be combinations of aerostats and helicopters or modern versions of more conventional aircraft. These latter types would not be competitive with high speed modern jet air transports on established routes, but they would have a role in special situations and as long-endurance Naval and coastal surveillance aircraft. The most attractive and immediate market for modern airships in the field of short-range and heavy lift.

A33831# ISSUE 13 PAGE 2329 CATEGORY 5 RPT#: AIAA 79-0847 79/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Large lighter-than-air vehicles
AUTH: A/MAYER, N. J. PAA: A/(NASA. Washington, D.C.)
CORP: National Aeronautics and Space Administration, Washington, D. C.
In: Very Large Vehicle Conference, Arlington, Va., April 26, 27, 1979. Technical Papers. (A79-33827 13-05) New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 45-52.
MAJS: /*AIRCRAFT DESIGN/*AIRSHIPS/*TECHNOLOGY UTILIZATION/*TRANSPORT AIRCRAFT
MINS: / AIR CARGO/ AIRCRAFT CONFIGURATIONS/ COST EFFECTIVENESS/ COST ESTIMATES/ PAYLOADS
ABA: (Author)
ABS: The background of experience and the results achieved in building large airships are discussed. Two current applications are identified. These are in heavy vertical lift and in long endurance patrol. The most promising concepts for these missions include hybrid combinations of helicopters and aerostats and more conventional rigid types. These new approaches will require some technology development in aerodynamics and structures, but all vehicles will benefit from application of modern methods and materials.

79N23913*# ISSUE 15 PAGE 1926 CATEGORY 2 79/00/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aircraft icing: Introduction
AUTH: A/ENDERS, J. H.
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A07/MF A01
In NASA. Lewis Res. Center Aircraft Icing 3 p (SEE N79-23912 15-02)
MAJS: /*AIRCRAFT HAZARDS/*ICE FORMATION
MINS: / FORECASTING/ RESEARCH AND DEVELOPMENT/ RESEARCH FACILITIES/ SAFETY MANAGEMENT/ VULNERABILITY
ABA: L.S.
ABS: The objectives of the Workshop were as follows: (1) to assess the current understanding of fixed wing and rotorcraft operational icing environments and problems (2) to evaluate facilities requirements for R&D and certification purposes (3) to examine means of improving icing forecasts (4) to identify shortcomings in aeronautical icing knowledge which can be alleviated by new research and instrumentation development.

79N24951*# ISSUE 16 PAGE 2069 CATEGORY 1 RPT#: NASA-TM-80541 78/10/15 189 PAGES UNCLASSIFIED DOCUMENT

UTTL: Advanced rotorcraft technology: Task force report
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A09/MF A01
MAJS: /*AEROACOUSTICS/*AERODYNAMIC CHARACTERISTICS/*AIRCRAFT STRUCTURES/*HELICOPTER DESIGN/*ROTARY WING AIRCRAFT
MINS: / AIRFRAMES/ AVIONICS/ CIVIL AVIATION/ FLIGHT CONTROL/ MILITARY HELICOPTERS/ PROPULSION SYSTEM PERFORMANCE/ ROTOR AERODYNAMICS
ABA: A.R.H.
ABS: The technological needs and opportunities related to future civil and military rotorcraft were determined and a program plan for NASA research which was responsive to the needs and opportunities was prepared. In general, the program plan places the primary emphasis on design methodology where the development and verification of analytical methods is built upon a sound data base. The four advanced rotorcraft technology elements identified are aerodynamics and structures, flight control and avionic systems, propulsion, and vehicle configurations. Estimates of the total funding levels that would be required to support the proposed program plan are included.

78A48452*# ISSUE 21 PAGE 3757 CATEGORY 7 RPT#: AIAA PAPER 78-928 78/07/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA engine system technology programs - An overview
AUTH: A/JOHNSON, H. W.: B/CONRAD, E. W. PAA: A/(NASA, Aeronautical Propulsion Div., Washington, D.C.): B/(NASA, Lewis Research Center, Energy Conservation Engines Office, Cleveland, Ohio)
CORP: National Aeronautics and Space Administration, Washington, D. C.: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
American Institute of Aeronautics and Astronautics and Society of Automotive Engineers, Joint Propulsion Conference, 14th, Las Vegas, Nev., July 25-27, 1978, AIAA 5 p.
MAJS: /*AIRCRAFT ENGINES/*ENGINE DESIGN/*NASA PROGRAMS/*PROPULSION SYSTEM CONFIGURATIONS
MINS: / AEROELASTICITY/ CIVIL AVIATION/ FUEL CONSUMPTION/ HELICOPTER ENGINES/ POLLUTION CONTROL/ QUIET ENGINE PROGRAM/ SUPERSONIC AIRCRAFT/ TECHNOLOGY ASSESSMENT/ TURBINE ENGINES/ TURBOPROP ENGINES/ VARIABLE CYCLE ENGINES
ABA: G.R.
ABS: The various propulsion systems technology programs are examined. The Stratospheric Cruise Emission Reduction

program has the objective to explore and demonstrate advanced technology fuel preparation and combustion systems which produce very low emission levels, particularly with respect to the oxides of nitrogen, during high altitude cruising flight. Other programs considered include the Quiet, Clean, General Aviation Turbofan program, the Variable Cycle Engine Technology program, the Helicopter Transmission Technology program, the Broad Specification Fuels Technology program, the Engine Component Improvement program, the Advanced Turboprop Technology program, the Supersonic Cruise Propulsion Technology program, the Materials for Advanced Turbine Engines program, and the Aeroelasticity of Turbine Engines program.

78A20651*# ISSUE 7 PAGE 1121 CATEGORY 7 RPT#: AIAA PAPER 78-43 78/01/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: A review of NASA's propulsion programs for civil aviation

AUTH: A/STEWART, W. L.; B/JOHNSON, H. W.; C/WEBER, R. J.
PAA: A/(NASA, Lewis Research Center, Cleveland, Ohio); B/(NASA, Aeronautical Propulsion Div., Washington, D.C.); C/(NASA, Lewis Research Center, Mission Analysis Branch, Cleveland, Ohio)

CORP: National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.; National Aeronautics and Space Administration, Washington, D. C.

American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 16th, Huntsville, Ala., Jan. 16-18, 1978, 14 p.

MAJS: /*AIRCRAFT ENGINES/*CIVIL AVIATION/*ENGINE DESIGN/* NASA PROGRAMS/*PROPULSION SYSTEM PERFORMANCE

MINS: / AIRCRAFT DESIGN/ ENERGY CONSERVATION/ POWERED LIFT AIRCRAFT/ RESEARCH AND DEVELOPMENT/ SUBSONIC AIRCRAFT/ SUPERSONIC AIRCRAFT/ TURBOFAN AIRCRAFT

ABA: (Author)

ABS: Five NASA engine-oriented propulsion programs of major importance to civil aviation are presented and discussed. Included are programs directed at exploring propulsion-system concepts for (1) energy-conservative subsonic aircraft (improved current turbofans, advanced turbofans, and advanced turboprops), (2) supersonic cruise aircraft (variable-cycle engines), (3) general aviation aircraft (improved reciprocating engines and small gas turbines), (4) powered-lift aircraft (advanced turbofans), and (5) advanced rotorcraft. These programs reflect the opportunities still existing for significant improvements in civil aviation through the application of advanced propulsion concepts

78N18041*# ISSUE 9 PAGE 1110 CATEGORY 5 RPT#: NASA-TM-75063 CNT#: NASW-2791 77/12/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: A new helicostat from SNIAS helicopter division

AUTH: A/MORISSET, J.

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01
Trans. by Scientific Translation Service, Santa Barbara, Calif. Transl. into ENGLISH from Air Cosmos (France), no. 653, 8 Jan. 1977 p 19-22 and 40

MAJS: /*HELICOPTER DESIGN/*HELICOPTER PERFORMANCE/*HIGH ALTITUDE BALLOONS

MINS: / BALLOONS/ HEAVY LIFT HELICOPTERS/ PRODUCT DEVELOPMENT/ STRUCTURAL DESIGN

ABA: Author

ABS: The Helicostat was described as a helicopter in which the vehicle weight is nullified by two balloons arranged in a catamaran fashion. Development of such a vehicle is discussed, and various uses for these helicopters are summarized.

78N11114*# ISSUE 2 PAGE 158 CATEGORY 8 RPT#: NASA-TM-75161 DLR-DB-552-76/12 CNT#: NASW-2791 77/10/00 68 PAGES UNCLASSIFIED DOCUMENT

Original language document was announced as N77-21085

UTTL: Concepts for the design of a completely active helicopter isolation system using output vector feedback

AUTH: A/SCHULZ, G.

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A04/MF A01
Transl. by Sci. Transl. Serv., Santa Barbara, Calif. Transl. into ENGLISH of ""Konzepte zur Auslegung eines Vollaktiven Hubschrauber-Schwingungs Isolations Systems mittels Ausgangsvektorrueckfuehrung''. Rept. DLR-DB-552-76/12 DFVLR, Oberpfaffenhofen, West Germ., Sep. 1976 63 p

MAJS: /*COMPUTERIZED SIMULATION/*FEEDBACK CONTROL/* HELICOPTER DESIGN/*OPTIMAL CONTROL/*VIBRATION DAMPING

MINS: / BO-105 HELICOPTER/ DIRECTIONAL CONTROL/ ROTOR AERODYNAMICS/ ROTOR BLADES (TURBOMACHINERY)

ABA: Author

ABS: The theory of output vector feedback (a few measured quantities) is used to derive completely active oscillation isolation functions for helicopters. These feedback controller concepts are tested with various versions of the BO 105 helicopter and their performance is demonstrated. A compensation of the vibrational excitations from the rotor and harmonics of the number of blades are considered. There is also a fast and automatic trim function for maneuvers.

78N17042*# ISSUE 8 PAGE 976 CATEGORY 5 RPT#: NASA-TM-75038 CNT#: NASW-2792 77/08/00 11 PAGES UNCLASSIFIED DOCUMENT
Translation was announced as A77-26913
UTTL: Aerospatiale is ready to develop a convertiplane with tethering rotors
AUTH: A/MORISSET, J.
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A02/MF A01
Transl. by Transemantics Inc., Washington, D.C.
Transl. into ENGLISH from Air et Cosmos (France), no. 662, 12 Mar. 1977 p 19-22
MAJS: /*AEROSPACE ENGINEERING/*ROTARY WINGS/*TETHERING/* V/STOL AIRCRAFT
MINS: / HELICOPTER DESIGN/ HELICOPTER PERFORMANCE/ HOVERING/ MILITARY AIRCRAFT/ PRODUCT DEVELOPMENT
ABA: Author
ABS: Information on the recent study of the convertiplane is reported. The convertiplane was designed to replace the conventional helicopter. Its speed is much faster than that of the helicopter, it uses less fuel, and can carry up to five passengers. The discovery of the convertiplane was brought about because the helicopter is handicapped by its slow speed and can carry only a few passengers.

74N20757* ISSUE 12 PAGE 1385 CATEGORY 5 74/02/00 6 PAGES UNCLASSIFIED DOCUMENT
UTTL: Technical evaluation of the Aerospace Medical Panel Specialists Meeting on Escape Problems and Manoeuvres in Combat Aircraft
AUTH: A/JONES, W. L.
CORP: National Aeronautics and Space Administration, Washington, D. C.
In AGARD Escape Probl. and Manoeuvres in Combat Aircraft 6 p (SEE N74-20756 12-05)
MAJS: /*AIRCRAFT EQUIPMENT/*EJECTION SEATS/*ESCAPE SYSTEMS/* HELICOPTERS/*SAFETY DEVICES/*V/STOL AIRCRAFT
MINS: / AERODYNAMIC FORCES/ HUMAN FACTORS ENGINEERING/ HUMAN TOLERANCES/ LIFE SUPPORT SYSTEMS
ABA: Author
ABS: A technical evaluation of the papers presented at a conference on escape systems for helicopters and V/STOL aircraft was made. The subjects discussed include the following: (1) bioengineering aspects of spinal injury during ejection, (2) aerodynamic forces acting on crewman during escape, (3) operational practicality of fly away ejection seats, (4) helicopter survivability requirements, (5) ejection experience from V/STOL aircraft, and (6) research projects involving escape and retrieval systems.

74N20756# ISSUE 12 PAGE 1385 CATEGORY 5 RPT#: AGARD-CP-134 74/02/00 121 PAGES UNCLASSIFIED DOCUMENT
UTTL: Escape problems and maneuvres in combat aircraft --- conference on aircraft escape systems for helicopters and V/STOL aircraft
AUTH: A/JONES, W. L. PAA: A/(NASA, Washington, D. C.) PAT: A/ed.
RP: Advisory Group for Aerospace Research and Development, Paris (France).; National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC $9.25
Papers Presented at Aerospace Med. Panel Specialists, Soesterberg, Netherlands, 4 Sep. 1973
MAJS: /*AIRCRAFT EQUIPMENT/*CONFERENCES/*EJECTION SEATS/* ESCAPE SYSTEMS
MINS: / HUMAN FACTORS ENGINEERING/ HUMAN TOLERANCES/ LIFE SUPPORT SYSTEMS/ SAFETY DEVICES
ANN: The proceedings of a conference on the subject of problems of escape from rotary wing and V/STOL aircraft are presented. The purpose of the meeting was to delineate the important aspects of the escape problems and to review new concepts in escape technology. The subjects covered was broad ranging from biomedical issues in air combat mishaps in high performance aircraft to human factors and engineering aspects of inflight escape in all types of aircraft.

73N19004* ISSUE 10 PAGE 1104 CATEGORY 2 RPT#: NASA-CASE-ERC-10439 US-PATENT-3,711,042
US-PATENT-APPL-SN-54271 US-PATENT-CLASS-244-77D
US-PATENT-CLASS-244-17.13 US-PATENT-CLASS-318-489
73/01/16 8 PAGES UNCLASSIFIED DOCUMENT
Filed 13 Jul. 1970 Supersedes N70-36052 (08 - 19, p 3471)
UTTL: Aircraft control system
UNOC: Aircraft control system for rotary wing aircraft
TLSP: Patent
AUTH: A/REMPFER, P. S.; B/ROBERTSON, A. J.; C/STEVENSON, L. E.; D/KOZIOL, J. S., JR. PAT: D/inventors (to NASA)
CORP: National Aeronautics and Space Administration, Washington, D. C. SAP: Avail: US Patent Office
MAJS: /*AIRCRAFT CONTROL/*ROTARY WING AIRCRAFT
MINS: / CONTROL STICKS/ FLIGHT PATHS/ INERTIAL PLATFORMS/ PATENTS/ TRANSLATIONAL MOTION
ABA: Official Gazette of the U.S. Patent Office
ABS: An aircraft control system is described which is particularly suited to rotary wing aircraft. Longitudinal acceleration and course rate commands are derived from a manual control stick to control translational velocity of the aircraft along a flight path. In the collective channel the manual controls

provide vertical velocity commands. In the yaw channel the manual controls provide sideslip or heading rate commands at high or low airspeeds, respectively. The control system permits pilots to fly along prescribed flight paths in a precise manner with relatively low work load.

72N13986*# ISSUE 5 PAGE 566 CATEGORY 2 RPT#:
NASA-TT-F-13938 NAL-TR-113 71/12/00 23 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Experimental study on the ground effect of a model helicopter rotor in hovering

UNOC: Aerodynamic characteristics of model helicopter hovering in ground effect flow

AUTH: A/KOO, J.; B/OKA, T.

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS
Transl. into ENGLISH of Natl. Aerospace Lab., Tokyo, report NAL-TR-113

MAJS: /*AERODYNAMIC CHARACTERISTICS/*GROUND EFFECT/* HELICOPTERS/*HOVERING

MINS: / AERODYNAMIC DRAG/ DOWNWASH/ FLOW VISUALIZATION

ABA: Author

ABS: Aerodynamic characteristics of a model helicopter rotor hovering in the ground effect have been experimentally investigated. Measurements of the thrust, torque and induced velocity of the hovering rotor in the ground effect/and flow visualizations around the hovering rotor in the ground effect by the use of tuft. The qualitative results obtained are as follows: (1) when a hovering rotor in higher pitch angle gets near to the ground, there is a saturation in the thrust increase from the ground effect according to the blade stall, and (2) it appears from flow observations that the periodical fluctuation of interference flow between down-wash and up-wash may introduce the unsteady phenomena of a hovering helicopter in the ground effect.

70N34028*# ISSUE 18 PAGE 3283 CATEGORY 2
70/07/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter testing in a wind tunnel

UNOC: Wind tunnel testing of helicopters, and test program for Polish helicopter industry

AUTH: A/BRODZKI, Z.

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS
TRANSL. INTO ENGLISH FROM BIUL. INFORM. INST. LOTNICTWA, V. 5, MAY-JUN. 1968 P 7-11

MAJS: /*AIRCRAFT INDUSTRY/*HELICOPTERS/*POLAND

MINS: / WIND TUNNEL APPARATUS/ WIND TUNNELS

PRINT 27/2/1-389 TERMINAL=20

82N74542*# CATEGORY 5 RPT#: AD-A113037
D210-10699-2 REV-2 NASA-CR-168697 NAS 1.26:168697
D210-10699-2-REV- NADC-78265-60 CNT#: NAS2-6107
N62269-79-C-0217 N62269-74-C-0757 79/10/00 852 PAGES UNCLASSIFIED DOCUMENT
Revised
UTTL: HESCOMP. The Helicopter Sizing and Performance Computer Program. User's manual, revision 2 TLSP: Final Report, Apr. - Oct. 1979
AUTH: A/DAVIS, S. J.; B/ROSENSTEIN, H.; C/STANZIONE, K. A.; D/WISNIEWSKI, J. S.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
MAJS: /*AIRCRAFT DESIGN/*COMPUTER PROGRAMS/*COMPUTERIZED DESIGN/*HELICOPTER PERFORMANCE/*HELICOPTERS/*SIZE (DIMENSIONS)/*USER MANUALS (COMPUTER PROGRAMS)
MINS: / AERODYNAMIC CONFIGURATIONS/ AIRCRAFT SPECIFICATIONS/ FUEL CONSUMPTION/ HELICOPTER ENGINES/ ROTARY WINGS

82N72152*# CATEGORY 2 RPT#: NASA-CR-3503 CNT#: PROJ. FEDD NCC-292 82/01/00 129 PAGES UNCLASSIFIED DOCUMENT DOMESTIC
UTTL: The investigation of a variable camber blade lift control for helicopter rotor systems TLSP: An Early Domestic Dissemination Report
AUTH: A/AWANI, A. O.
CORP: Kansas Univ. Center for Research, Inc., Lawrence. SAP: Avail: NASA Industrial Applications Centers only to U.S. requesters: HC A07/MF A01
MAJS: /*CONTROL STABILITY/*HELICOPTER CONTROL/*HOVERING/*ROTARY WINGS/*ROTOR AERODYNAMICS/*WING CAMBER
MINS: / AIRFOIL PROFILES/ DYNAMIC CHARACTERISTICS

82N71777* CATEGORY 2 RPT#: NASA-CR-165848
PPI-1002-2 CNT#: NAS1-15961 81/12/00 112 PAGES UNCLASSIFIED DOCUMENT
UTTL: Implementation of refinements in a dynamic analysis of periodic systems TLSP: Final Report
AUTH: A/DREIER, M. E.
CORP: Paragon Pacific, Inc., El Segundo, Calif. AVAIL.NTIS
MAJS: /*DYNAMIC RESPONSE/*HELICOPTERS/*ROTOR AERODYNAMICS/*SYSTEMS ANALYSIS/*WINDMILLS (WINDPOWERED MACHINES)
MINS: / ACTIVE CONTROL/ AEROELASTICITY/ COMPUTER PROGRAMS/ DYNAMIC STABILITY/ WAKES

81N77030* CATEGORY 66 RPT#: NASA-CR-164740
JPL-STA-650-89-VOL-2 70/09/08 2 VOLS 96 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effectiveness analysis of helicopter patrols, volume 2: Evaluation
CORP: Jet Propulsion Lab., California Inst. of Tech., Pasadena. AVAIL.NTIS
MAJS: /*AERIAL RECONNAISSANCE/*HELICOPTERS/*POLICE/*PREDICTION ANALYSIS TECHNIQUES/*RECONNAISSANCE AIRCRAFT/*STATISTICAL ANALYSIS
MINS: / DEMOGRAPHY/ SOCIOLOGY/ TECHNOLOGY TRANSFER/ URBAN RESEARCH/ VIOLENCE

81N77029* CATEGORY 66 RPT#: NASA-CR-164739
JPL-STA-650-89-VOL-1 70/07/27 2 VOLS 37 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effectiveness analysis of helicopter patrols, volume 1: Summary
CORP: Jet Propulsion Lab., California Inst. of Tech., Pasadena. AVAIL.NTIS
MAJS: /*AERIAL RECONNAISSANCE/*HELICOPTERS/*POLICE/*PREDICTION ANALYSIS TECHNIQUES/*RECONNAISSANCE AIRCRAFT/*STATISTICAL ANALYSIS
MINS: / DEMOGRAPHY/ SOCIOLOGY/ TECHNOLOGY TRANSFER/ URBAN RESEARCH/ VIOLENCE

81N75843* CATEGORY 5 RPT#: NASA-CR-166219
REPT-699-099-003 CNT#: NAS2-8866 75/09/17 405 PAGES UNCLASSIFIED DOCUMENT
UTTL: Planning study for implementation of Tilt Rotor Technologies for operational aircraft TLSP: Final Report
CORP: Textron Bell Helicopter, Fort Worth, Tex. Sponsored in part by Army
MAJS: /*PROJECT PLANNING/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*XV-15 AIRCRAFT
MINS: / COMPOSITE STRUCTURES/ ENGINE DESIGN/ TILT ROTOR AIRCRAFT/ WEIGHT REDUCTION

81N74340* CATEGORY 5 RPT#: NASA-CR-164241
LIDS-R-1087 CNT#: NGL-22-009-124 81/04/00 24 PAGES UNCLASSIFIED DOCUMENT
UTTL: Report on trip to NASA Ames Research Center Flight Dynamics and Controls Branch, 19-23 Jan. 1981
AUTH: A/MCMULDROCH, C. G.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Lab. for Information and Decision Systems.) AVAIL.NTIS
MAJS: /*AERODYNAMIC BALANCE/*AIRCRAFT CARRIERS/*AIRCRAFT CONTROL/*AIRCRAFT LANDING/*DISPLAY DEVICES/*GROUND TESTS/*HARRIER AIRCRAFT/*HELICOPTERS/*TILT ROTOR AIRCRAFT/*V/STOL AIRCRAFT

MINS: / MATHEMATICAL MODELS/ MOTION SIMULATORS/ PREDICTION ANALYSIS TECHNIQUES/ X-14 AIRCRAFT

80N74992* CATEGORY 2 RPT#: NASA-CR-159313 CNT#: NSG-1174 80/07/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: A direct-inverse technique for low speed high lift airfoil-field analysis TLSP: Progress Report
AUTH: A/CARLSON, L. A.
CORP: Texas A&M Univ., College Station. CSS: (Dept. of Aerospace Engineering.) AVAIL.NTIS
MAJS: /*AIRFOILS/*MATHEMATICAL MODELS/*PREDICTION ANALYSIS TECHNIQUES/*SEPARATED FLOW/*VISCOUS FLOW
MINS: / AERODYNAMIC CONFIGURATIONS/ AIRFOIL PROFILES/ CONTROL SURFACES/ HELICOPTERS/ REYNOLDS NUMBER

79N76846*# CATEGORY 1 RPT#: AD-A063246 USARTL-TN-31 78/11/00 35 PAGES UNCLASSIFIED DOCUMENT
UTTL: US army helicopter drive system overhaul management
AUTH: A/ARTIS, D. R., JR.; B/WELNER, V. W.
CORP: Air Force Systems Command, Wright-Patterson AFB, Ohio. AVAIL.NTIS
MAJS: /*AIRCRAFT MAINTENANCE/*HELICOPTERS/*MECHANICAL DRIVES
MINS: / ARMED FORCES (UNITED STATES)/ FEASIBILITY ANALYSIS

78N76225* CATEGORY 2 RPT#: NASA-CR-156925 CNT#: NGR-03-010-085 74/00/00 8 PAGES UNCLASSIFIED DOCUMENT
UTTL: Some research on helicopter rotor noise thickness and rotational noise
AUTH: A/FARASSAT, F.
CORP: Joint Inst. for Acoustics and Flight Sciences, Hampton, Va. AVAIL.NTIS
Presented at 2d Interagency Symp. on Univ. Res. in Transportation Noise, Raleigh, N. C., 5-7 Jun. 1974
MAJS: /*AIRCRAFT NOISE/*COMPUTER PROGRAMS/*HELICOPTERS
MINS: / ANALYSIS (MATHEMATICS)/ NOISE MEASUREMENT/ NOISE PROPAGATION

78N72042*# CATEGORY 5 RPT#: AD-A046367 D210-10699-2 CNT#: N62269-74-C-0757 NAS2-6107 74/11/00 529 PAGES UNCLASSIFIED DOCUMENT
Revised
UTTL: HESCOMP: The helicopter sizing and performance computer program. Users manual, revision
AUTH: A/DAVIS, S. J.; B/WISNIEWSKI, J. S.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
MAJS: /*COMPUTER PROGRAMS/*HELICOPTER PERFORMANCE/*USER MANUALS (COMPUTER PROGRAMS)
MINS: / AERONAUTICAL ENGINEERING/ PERFORMANCE TESTS/ PROPULSION SYSTEM PERFORMANCE/ ROTARY WINGS/ SIZE (DIMENSIONS)

77N80570* CATEGORY 5 RPT#: NASA-CR-152018 D120-10699-1 CNT#: NAS2-6107 73/09/00 466 PAGES UNCLASSIFIED DOCUMENT
UTTL: User's manual for HESCOMP, the helicopter sizing and performance computer program
AUTH: A/DAVIS, S. J.; B/WISNIEWSKI, J. S.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
MAJS: /*AIRCRAFT PERFORMANCE/*HELICOPTERS/*USER MANUALS (COMPUTER PROGRAMS)
MINS: / COMPUTER PROGRAMS/ INPUT/OUTPUT ROUTINES/ SPECIFICATIONS

76N75191* CATEGORY 98 RPT#: NASA-CR-148124 ESS-4026-101-76 CNT#: NSG-1274 76/06/00 5 PAGES UNCLASSIFIED DOCUMENT
UTTL: System studies of factors affecting the acceptance of helicopter transportation TLSP: Semiannual Status Report, 15 Jan. - 14 Jun. 1976
AUTH: A/JACOBSON, I. D.
CORP: Virginia Univ., Charlottesville. CSS: (School of Engineering and Applied Science.) AVAIL.NTIS
MAJS: /*HELICOPTERS/*MARKETING/*PASSENGER AIRCRAFT
MINS: / AIRLINE OPERATIONS/ COMMERCIAL AIRCRAFT

76N72779* CATEGORY 98 RPT#: NASA-CR-134988 CNT#: NAS3-19414 71/02/00 77 PAGES UNCLASSIFIED DOCUMENT
UTTL: Variable pitch, lift-cruise fan system study
AUTH: A/LEVINTAN, R. M.; B/MATTHEWS, P. A.; C/SEERY, M. E.
CORP: Hamilton Standard, Windsor Locks, Conn. AVAIL.NTIS
MAJS: /*LIFT FANS/*V/STOL AIRCRAFT/*VARIABLE PITCH PROPELLERS
MINS: / DESIGN ANALYSIS/ HELICOPTER DESIGN/ THRUST

75N76668* CATEGORY 98 RPT#: NASA-CR-143569 CNT#: NSG-1143 75/09/10 28 PAGES UNCLASSIFIED DOCUMENT
UTTL: Sensor for measuring instantaneous angle of attack of helicopter blades TLSP: Progress Report, 13 Jan. - 13 Jul. 1975
AUTH: A/BARNA, P. S.
CORP: Old Dominion Univ., Norfolk, Va. AVAIL.NTIS
MAJS: /*ANGLE OF ATTACK/*BLADES/*FLOW MEASUREMENT/*HELICOPTERS/*WIND VELOCITY
MINS: / CASCADE WIND TUNNELS/ LASER DOPPLER VELOCIMETERS/ PRESSURE MEASUREMENT/ WIND TUNNEL STABILITY TESTS/ WIND VANES

75N75474* CATEGORY 98 RPT#: NASA-CR-143125 CNT#: NSG-1121 75/07/00 2 PAGES UNCLASSIFIED DOCUMENT
UTTL: The potential role of the helicopter in urban transportation TLSP: Semiannual Progress Report, Jan. - Jun. 1975
AUTH: A/DAJANI, J. S.
CORP: Duke Univ., Durham, N. C. AVAIL.NTIS
MAJS: /*HELICOPTERS/*URBAN TRANSPORTATION
MINS: / AIRPORTS/ ECONOMIC FACTORS

75N74607* CATEGORY 98 RPT#: NASA-CR-142972 SATPR-1 CNT#: NSG-1114 75/05/00 24 PAGES UNCLASSIFIED DOCUMENT
UTTL: Structural dynamics, stability and control of helicopters TLSP: Semiannual Technical Progress Report, 1 Nov. 1974 - 30 Apr. 1975
AUTH: A/METROVITCH, L.; B/HALE, A. L.
CORP: Virginia Polytechnic Inst. and State Univ., Blacksburg. CSS: (Dept. of Engineering Science and Mechanics.) AVAIL.NTIS
MAJS: /*EULER-LAGRANGE EQUATION/*HELICOPTER CONTROL/* HELICOPTERS
MINS: / EIGENVALUES/ EQUATIONS OF MOTION/ FUSELAGES/ HELICOPTER PERFORMANCE/ LIFTING ROTORS/ ROTARY STABILITY/ ROTOR AERODYNAMICS

82N24050*# ISSUE 14 PAGE 2018 CATEGORY 71 RPT#: NASA-CR-166337 NAS 1.26:166337 CNT#: NAS2-10767 82/04/00 100 PAGES UNCLASSIFIED DOCUMENT
UTTL: An investigation of rotor harmonic noise by the use of small scale wind tunnel models TLSP: Final Report
AUTH: A/STERNFELD, H., JR.; B/SCHAFFER, E. G.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*AIRCRAFT NOISE/*HARMONICS/*NOISE MEASUREMENT/*ROTARY WINGS
MINS: / ACOUSTICS/ SCALE MODELS/ WIND TUNNEL TESTS
ABA: Author
ABS: Noise measurements of small scale helicopter rotor models were compared with noise measurements of full scale helicopters to determine what information about the full scale helicopters could be derived from noise measurements of small scale helicopter models. Comparisons were made of the discrete frequency (rotational) noise for 4 pairs of tests. Areas covered were tip speed effects, isolated rotor, tandem rotor, and main rotor/tail rotor interaction. Results show good comparison of noise trends with configuration and test condition changes, and good comparison of absolute noise measurements with the corrections used except for the isolated rotor case. Noise measurements of the isolated rotor show a great deal of scatter reflecting the fact that the rotor in hover is basically unstable.

82N23229*# ISSUE 14 PAGE 1901 CATEGORY 3 82/04/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: A pilot in the loop analysis of helicopter acceleration/deceleration maneuvers
AUTH: A/HEFFLEY, R. K.
CORP: Systems Technology, Inc., Mountain View, Calif. AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 221-232 (SEE N82-23208 14-03)
MAJS: /*ACCELERATION (PHYSICS)/*FLIGHT SIMULATION/*FLIGHT TRAINING/*HELICOPTER PERFORMANCE
MINS: / AIRCRAFT MANEUVERS/ HOVERING STABILITY/ NAP-OF-THE EARTH NAVIGATION/ PILOT PERFORMANCE
ABA: Author
ABS: Helicopter flight acceleration, deceleration maneuvers are quantified and put to use in the fields of handling qualities, flight training and evaluation of simulator fidelity. The three specific cases include the normal speed change maneuver, the nap-of-the-Earth dash/quickstop, and the decelerating approach to hover. All of these maneuvers share common generic features in terms of pilot adaptation and mathematical description; yet each differs in terms of the essential feedback loop structure. Implications for handling qualities requirements, and simulator fidelity criteria.

82N23228*# ISSUE 14 PAGE 1901 CATEGORY 3 82/04/00 11 PAGES UNCLASSIFIED DOCUMENT
UTTL: Past applications and future potential of variable stability research helicopters
AUTH: A/HINDSON, W. S.
CORP: Stanford Univ., Calif. CSS: (Joint Inst. of Aeronautics and Acoustics.) AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 209-219 (SEE N82-23208 14-03)
MAJS: /*HELICOPTER DESIGN/*ROTARY WING AIRCRAFT/*VARIABLE PITCH PROPELLERS
MINS: / HELICOPTER PERFORMANCE/ HISTORIES/ TECHNOLOGICAL FORECASTING
ABA: Author
ABS: The historical development of variable-stability research helicopters and some of their previous applications are presented as a guide for assessing their future potential. The features of three general-purpose rotary-wing flight research aircraft that provide complementary capabilities are described

...rently, and a number of future applications are proposed.

82N23226*# ISSUE 14 PAGE 1900 CATEGORY 3
82/04/09 6 PAGES UNCLASSIFIED DOCUMENT
UTTL: New development in flying qualities with application to rotary wing aircraft
AUTH: A/HOH, R. H.
CORP: Systems Technology, Inc., Hawthorne, Calif.
AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 193-198 (SEE N82-23208 14-03)
MAJS: /*FIXED WINGS/*HELICOPTER PERFORMANCE/*ROTARY WING AIRCRAFT
MINS: / HANDBOOKS/ HELICOPTER DESIGN/ STANDARDS
ABA: Author
ABS: Some recent considerations and developments in handling quality criteria are reviewed with emphasis on using fixed wing experience gained in developing MIL-F-8785C and the more recent MIL Standard and Handbook. Particular emphasis is placed on the tasks and environmental conditions used to develop the criterion boundaries, SAS failures, and potential fixed wing criteria that are applicable to rotary wing aircraft.

82N23225*# ISSUE 14 PAGE 1900 CATEGORY 3
82/04/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Integrated cockpit for A-129
AUTH: A/REINA, F.; B/GRACIA, J. J.; C/KOTH, B. W. PAA: B/(Harris Government Information Systems Div.); C/(Harris Government Information systems Div.)
CORP: Costruzioni Aeronautiche Giovanni Agusta S.p.A., Samarate (Italy). CSS: (Helicopter Systems Engineering Div.) AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 183-192 (SEE N82-23208 14-03)
MAJS: /*AVIONICS/*CATHODE RAY TUBES/*COCKPITS/*DISPLAY DEVICES/*HELICOPTER DESIGN
MINS: / DESIGN ANALYSIS/ HELICOPTER CONTROL/ INFORMATION RETRIEVAL/ STANDARDS/ SYSTEMS ENGINEERING
ABA: Author
ABS: Weight, size, and mission requirements for the A-129 mandated an integrated system approach for the crew/cockpit interface design. Instead of the usual multitude of cockpit controls, indicators, gauges, and lights, the primary crew interface is a single multifunction keyboard and one or more multifunction CRT display units. This cockpit design approach imposed unusual constraints upon the system architecture to overcome the inherent information access limitations of a data input/output window that was restricted by the available space. The conceptual approach and resulting design of the A-129 cockpit with the intent to enhance the development of cockpit standardization are described.

82N23224*# ISSUE 14 PAGE 1900 CATEGORY 3
82/04/00 11 PAGES UNCLASSIFIED DOCUMENT
UTTL: Cockpit integration from a pilot's point of view
AUTH: A/GREEN, D. L.
CORP: Pacer Systems, Inc., Arlington, Va. AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 171-181 (SEE N82-23208 14-03)
MAJS: /*AIRCRAFT CONTROL/*COCKPITS/*DISPLAY DEVICES/*HELICOPTER DESIGN/*MILITARY HELICOPTERS
MINS: / AIRCRAFT INSTRUMENTS/ ALTIMETERS/ CONTROL/ DIRECTIONAL CONTROL/ FLIGHT CONTROL/ HUMAN FACTORS ENGINEERING/ YAW
ABA: M.D.K.
ABS: Extensive experience in both operational and engineering test flight was used to suggest straightforward changes to helicopter cockpit and control system design that would improve pilot performance in marginal and instrument flight conditions. Needed control system improvements considered include: (1) separation of yaw from cyclic force trim, (2) pedal force proportional to displacement rate; and (3) integration of engine controls in collective stick. Display improvements needed include: (1) natural coding of yaw rate in attitude indicator; (2) collective position indication and radar altimeter placed within primary scan; and (3) omnidirectional display of full range airspeed data.

82N23220*# ISSUE 14 PAGE 1900 CATEGORY 3
82/04/00 5 PAGES UNCLASSIFIED DOCUMENT
UTTL: State-of-the-art cockpit design for the HH-65A helicopters
AUTH: A/CASTLEBERRY, D. E.; B/MCELREATH, M. Y.
CORP: Rockwell International Corp., Cedar Rapids, Iowa. CSS: (Government Avionics Div.) AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 139-143 (SEE N82-23208 14-03)
MAJS: /*AIRCRAFT CONTROL/*AIRCRAFT DESIGN/*COCKPITS/*DISPLAY DEVICES/*FLIGHT CONTROL/*MILITARY HELICOPTERS
MINS: / AIRCRAFT COMPARTMENTS/ CATHODE RAY TUBES/ COMPUTER TECHNIQUES/ CONTROL/ DATA PROCESSING/ DIGITAL SYSTEMS/ FLIGHT TESTS/ MILITARY TECHNOLOGY/ MULTIPLEXING/ VIDEO EQUIPMENT
ABA: M.D.K.

ABS: In the design of a HH-65A helicopter cockpit, advanced integrated electronics systems technology was employed to achieve several important goals for this multimission aircraft. They were: (1) integrated systems operation with consistent and simplified cockpit procedures; (2) mission-task-related cockpit displays and controls, and (3) reduced pilot instrument scan effort with excellent outside visibility. The integrated avionics system was implemented to depend heavily upon distributed but complementary processing, multiplex digital bus technology, and multifunction CRT controls and displays. This avionics system was completely flight tested and will soon enter operational service with the Coast Guard.

82N23216*# ISSUE 14 PAGE 1899 CATEGORY 3
82/04/00 22 PAGES UNCLASSIFIED DOCUMENT

UTTL: An assessment of various side-stick controller/stability and control augmentation systems for night nap-of-Earth flight using piloted simulation

AUTH: A/LANDIS, K. H.; B/AIKEN, E. W. PAA: B/(Army Research and Technology Labs., Moffett Field, Calif.)

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter handling Qualities p 75-96 (SEE N82-23208 14-03)

MAJS: /*CONTROLLABILITY/*CONTROLLERS/*FLIGHT CONTROL/* HELICOPTER CONTROL/*NAP-OF-THE-EARTH NAVIGATION/*NIGHT FLIGHTS (AIRCRAFT)/*STABILITY AUGMENTATION

MINS: / AIRCRAFT MANEUVERS/ FLIGHT SIMULATION/ HELMET MOUNTED DISPLAYS/ MILITARY HELICOPTERS/ NIGHT VISION/ PILOT PERFORMANCE/ VISUAL FLIGHT

ABA: T.M.

ABS: Several night nap-of-the-earth mission tasks were evaluated using a helmet-mounted display which provided a limited field-of-view image with superimposed flight control symbology. A wide range of stability and control augmentation designs was investigated. Variations in controller force-deflection characteristics and the number of axes controlled through an integrated side-stick controller were studied. In general, a small displacement controller is preferred over a stiffstick controller particularly for maneuvering flight. Higher levels of stability augmentation were required for IMC tasks to provide handling qualities comparable to those achieved for the same tasks conducted under simulated visual flight conditions.

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82N23214*# ISSUE 14 PAGE 1899 CATEGORY 3
82/04/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: A helicopter handling-qualities study of the effects of engine response characteristics, height-control dynamics, and excess power on nap-of-the-Earth operations

AUTH: A/CORLISS, L. D.

CORP: Army Research and Technology Labs., Moffett Field, Calif. AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 47-57 (SEE N82-23208 14-03)

MAJS: /*AIRCRAFT MANEUVERS/*CONTROLLABILITY/*DYNAMIC RESPONSE/*ENGINE CONTROL/*GAS TURBINE ENGINES/* HELICOPTER CONTROL/*HELICOPTER ENGINES/* NAP-OF-THE-EARTH NAVIGATION

MINS: / ELECTRIC CONTROL/ FLIGHT SIMULATORS/ FUEL CONTROL/ FUEL INJECTION

ABA: T.M.

ABS: The helicopter configuration with an rpm-governed gas-turbine engine was examined. A wide range of engine response time, vehicle damping and sensitivity, and excess power levels was studied. The data are compared with the existing handling-qualities specifications, MIL-F-83300 and AGARD 577, and in general show a need for higher minimums when performing such NOE maneuvers as a dolphin and bob-up task.

82N23213*# ISSUE 14 PAGE 1899 CATEGORY 3
82/04/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flight tests for the assessment of task performance and control activity

AUTH: A/PAUSDER, H. J.; B/HUMMES, D.

CORP: Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). CSS: (Inst. fuer Flugmechanik.) AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 35-46 (SEE N82-23208 14-03)

MAJS: /*AIRCRAFT MANEUVERS/*BO-105 HELICOPTER/*FLIGHT CONTROL/*FLIGHT TESTS/*HELICOPTER CONTROL/* NAP-OF-THE-EARTH NAVIGATION/*PILOT PERFORMANCE/*UH-1 HELICOPTER

MINS: / ATTITUDE CONTROL/ CONTROLLABILITY/ DATA ACQUISITION/ HELICOPTER PERFORMANCE/ HOVERING/ MILITARY OPERATIONS

ABA: T.M.

ABS: The tests were performed with the helicopters BO 105 and UH-1D. Closely connected with tactical demands the six test pilots' task was to minimize the time and the altitude over the obstacles. The data reduction yields statistical evaluation parameters describing the control activity of the pilots and the achieved task performance. The results are shown in form of evaluation diagrams. Additionally dolphin tests with

varied control strategy were performed to get more insight into the influence of control techniques. From these test results recommendations can be derived to emphasize the direct force control and to reduce the collective to pitch crosscoupling for the dolphin.

82N23212*# ISSUE 14 PAGE 1899 CATEGORY 3
82/04/00 11 PAGES UNCLASSIFIED DOCUMENT
UTTL: Influence of maneuverability on helicopter combat effectiveness
AUTH: A/FALCO, M.; B/SMITH, R. PAA: B/(Army Aviation Research and Development Command, St. Louis, Mo.)
CORP: Grumman Aerospace Corp., Bethpage, N.Y. AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 23-33 (SEE N82-23208 14-03)
MAJS: /*COMBAT/*EFFECTIVENESS/*HELICOPTER PERFORMANCE/*MANEUVERABILITY/*MILITARY HELICOPTERS
MINS: / AIRCRAFT RELIABILITY/ CONTROLLABILITY/ FEEDBACK CONTROL/ HELICOPTER CONTROL/ WEAPON SYSTEMS
ABA: T.M.
ABS: A computational procedure employing a stochastic learning method in conjunction with dynamic simulation of helicopter flight and weapon system operation was used to derive helicopter maneuvering strategies. The derived strategies maximize either survival or kill probability and are in the form of a feedback control based upon threat visual or warning system cues. Maneuverability parameters implicit in the strategy development include maximum longitudinal acceleration and deceleration, maximum sustained and transient load factor turn rate at forward speed, and maximum pedal turn rate and lateral acceleration at hover. Results are presented in terms of probability of skill for all combat initial conditions for two threat categories.

82N23211*# ISSUE 14 PAGE 1898 CATEGORY 3
82/04/00 8 PAGES UNCLASSIFIED DOCUMENT
UTTL: Boeing 234 flight control development
AUTH: A/MORRIS, J. J.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 15-22 (SEE N82-23208 14-03)
MAJS: /*ATTITUDE CONTROL/*AUTOMATIC FLIGHT CONTROL/*BOEING AIRCRAFT/*HELICOPTER CONTROL
MINS: / AIRCRAFT INSTRUMENTS/ CERTIFICATION/ CH-47 HELICOPTER/ MANEUVERABILITY/ NAVIGATION AIDS/ RADAR NAVIGATION
ABA: Author
ABS: The Boeing 234 is the commercially certified derivative of the CH-47 Chinook. The automatic flight control system and flight director with coupler were designed to reduce pilot work-load for missions of approximately six hour duration during VFR, IFR, day and night conditions. The AFCS system for the 234 is essentially the same system as developed for the CH-47D, which has airspeed hold, attitude hold, and maneuver enhancement in all three axes. The system also has the capability to couple to the Sperry Helcis flight director system which provides for enroute navigation and landing approaches. Certification testing was completed, by both the FAA and CAA, to FAR Part 29 for Transport Category Rotorcraft and BCAR Section G: Rotorcraft. The aircraft was certified for civil operation in June 1981.

82N23210*# ISSUE 14 PAGE 1898 CATEGORY 3
82/04/00 5 PAGES UNCLASSIFIED DOCUMENT
UTTL: Civil (French/US) certification of the Coast Guard's HH-65A Dauphin
AUTH: A/HART, J. C.; B/BESSE, J. M.; C/MCELREATH, K. W.
PAA: B/(Societe Nationale Industrielle Aerospatiale, Marignane, France); C/(Rockwell Collins Government Avionics Div., Cedar Rapids, Iowa)
CORP: Aerospatiale Helicopter Corp., Grand Prairie, Tex. AVAIL.NTIS SAP: HC A011/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 9-13 (SEE N82-23208 14-03)
MAJS: /*AIRCRAFT RELIABILITY/*AVIONICS/*CERTIFICATION/*CIVIL AVIATION/*FLIGHT TESTS/*MILITARY HELICOPTERS
MINS: / AUTOMATIC FLIGHT CONTROL/ EVALUATION/ HELICOPTER CONTROL/ PERFORMANCE TESTS/ QUALITY CONTROL
ABA: T.M.
ABS: Certification programs with particular emphasis on handling qualities requirements are described. A dynamic simulator was designed and constructed to support and verify the dynamic aspects of the avionics system, particularly the Automatic Flight Control System (AFCS). The role of the Dynamic Simulator is discussed.

82N23209*# ISSUE 14 PAGE 1898 CATEGORY 3
82/04/00 7 PAGES UNCLASSIFIED DOCUMENT
UTTL: VTOL and VSTOL handling qualities specifications, an overview of the current status
AUTH: A/GOLDSTEIN, K. W.
CORP: Naval Air Development Center, Warminster, Pa. AVAIL.NTIS SAP: HC A11/MF A01
In NASA. Ames Research Center Helicopter Handling Qualities p 1-7 (SEE N82-23208 14-03)
MAJS: /*AIRCRAFT SPECIFICATIONS/*CONTROLLABILITY/*HELICOPTER CONTROL/*MILITARY HELICOPTERS/ V/STOL AIRCRAFT
MINS: / ANGLE OF ATTACK/ ATTITUDE CONTROL/ CONTROL STABILITY

/ FLIGHT CONTROL/ HOVERING/ LATERAL CONTROL/ LONGITUDINAL CONTROL

ABA: T.M.

ABS: The highlights of a comparative analysis between the current helicopter and VSTOL specifications and four representative rotary wing aircraft are presented. Longitudinal, lateral, and directional control power and dynamic stability characteristics were analyzed for hovering conditions. Forward flight static and dynamic stability were analyzed for the longitudinal and lateral-directional axes. Results of the analyses in terms of the applicability/utility of the MIL-H-8501A criteria are presented for each of the above areas. The review of the MIL-H-8301A criteria against those in MIL-F-83300 and AGARD 577 indicate many areas in which MIL-H-8501A does not give adequate design guidance.

82N22250*# ISSUE 13 PAGE 1758 CATEGORY 5 RPT#: NASA-CR-166313 NAS 1.26:166313 STI-TR-1156-1 CNT#: NAS2-10400 80/05/00 91 PAGES UNCLASSIFIED DOCUMENT

UTTL: A theory of human error TLSP: Final Report

AUTH: A/MCRUER, D. T.; B/CLEMENT, W. F.; C/ALLEN, R. W.

CORP: Systems Technology, Inc., Hawthorne, Calif.

AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*AIRCRAFT ACCIDENTS/*HUMAN BEHAVIOR/*HUMAN FACTORS ENGINEERING/*OPERATORS (PERSONNEL)/*PILOT ERROR

MINS: / AIR NAVIGATION/ AIR TRAFFIC CONTROL/ AIRCRAFT SAFETY / DECISION MAKING/ FLIGHT SIMULATION/ MAN MACHINE SYSTEMS/ MANUAL CONTROL

ABA: B.W.

ABS: Human error, a significant contributing factor in a very high proportion of civil transport, general aviation, and rotorcraft accidents is investigated. Correction of the sources of human error requires that one attempt to reconstruct underlying and contributing causes of error from the circumstantial causes cited in official investigative reports. A validated analytical theory of the input-output behavior of human operators involving manual control, communication, supervisory, and monitoring tasks which are relevant to aviation operations is presented. This theory of behavior, both appropriate and inappropriate, provides an insightful basis for investigating, classifying, and quantifying the needed cause-effect relationships governing propagation of human error.

82N22249*# ISSUE 13 PAGE 1758 CATEGORY 5 RPT#: NASA-CR-166314 NAS 1.26:166314 STI-TR-1156-2 CNT#: NAS2-10400 80/05/00 140 PAGES UNCLASSIFIED DOCUMENT

UTTL: Technical approaches for measurement of human errors TLSP: Final Report

AUTH: A/CLEMENT, W. F.; B/HEFFLEY, R. K.; C/JEWELL, W. F.; D/MCRUER, D. T.

CORP: Systems Technology, Inc., Hawthorne, Calif.

AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /*AIRCRAFT ACCIDENTS/*ERROR ANALYSIS/*HUMAN FACTORS ENGINEERING/*MAN MACHINE SYSTEMS/*PILOT PERFORMANCE

MINS: / AIRCRAFT SAFETY/ FLIGHT SIMULATION/ HUMAN REACTIONS/ PSYCHOMOTOR PERFORMANCE

ABA: S.L.

ABS: Human error is a significant contributing factor in a very high proportion of civil transport, general aviation, and rotorcraft accidents. The technical details of a variety of proven approaches for the measurement of human errors in the context of the national airspace system are presented. Unobtrusive measurements suitable for cockpit operations and procedures in part of full mission simulation are emphasized. Procedure, system performance, and human operator centered measurements are discussed as they apply to the manual control, communication, supervisory, and monitoring tasks which are relevant to aviation operations.

82N22244*# ISSUE 13 PAGE 1757 CATEGORY 5 RPT#: NASA-CR-166322 NAS 1.26:166322 CNT#: NAS2-10278 80/08/00 33 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conceptual design study of a visual system for a rotorcraft simulator and some advances in platform motion utilization TLSP: Final Report

AUTH: A/SINACORI, J. B.

CORP: Sinacori (John B.) Associates, Hollister, Calif.

AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*AIRCRAFT DESIGN/*FLIGHT SIMULATORS/*HELICOPTERS/* TECHNOLOGY ASSESSMENT/*VISUAL CONTROL

MINS: / FEASIBILITY ANALYSIS/ FLIGHT SAFETY/ ROTARY WING AIRCRAFT/ TRAINING DEVICES/ TRAINING SIMULATORS

ABA: Author

ABS: A conceptual design of a visual system for a rotorcraft flight simulator is presented. Also, drive logic elements for a coupled motion base for such a simulator are given. The design is the result of an assessment of many potential arrangements of electro-optical elements and is a concept considered feasible for the application. The motion drive elements represent an example logic for a coupled motion base and is essentially an appeal to the designers of such logic to combine their washout and

braking functions.

82N21157*# ISSUE 12 PAGE 1603 CATEGORY 2 RPT#: NASA-CR-166287 NAS 1.26:166287 USAAVRADCOM-TR-82-A-3 SER-510048 CNT#: DAAK51-80-C-0016 81/05/00 102 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aeroelastic analysis of the elastic gimbal rotor TLSP: Report, May 1980 - May 1981

AUTH: A/CARLSON, R. G.; B/MIAO, W. L.

CORP: Sikorsky Aircraft, Stratford, Conn.; Army Research and Technology Labs., Fort Eustis, Va. AVAIL.NTIS SAP: HC A06/MF A01

Prepared for Army Research and Technology Labs.

MAJS: /*AEROELASTICITY/*BEARINGS/*GIMBALS/*HELICOPTER DESIGN/*HELICOPTERS/*HUBS/*ROTARY WINGS

MINS: / COMPUTER PROGRAMS/ CORIOLIS EFFECT/ EQUATIONS OF MOTION/ FLEXIBILITY/ FLIGHT CHARACTERISTICS/ LOADS (FORCES)/ SHAFTS (MACHINE ELEMENTS)/ STIFFNESS

ABA: B.W.

ABS: An aeroelastic and structural loads analysis of the elastic gimbal rotor (EGR) was conducted. The structural loads analysis of the elastic gimbal rotor indicated that the gimbal spring element is the critical component in the rotor system design, but that practical designs for all components should be achievable. The aeroelastic analysis was conducted using a version of the G400 Rotor Aeroelastic Analysis especially modified to evaluate the EGR. Hover stability showed that a stiff inplane blade was more stable than a soft inplane blade. Stability was sensitive to control system coupling (pitch gimbal coupling), gimbal spring stiffness, and blade frequency placement. Ground resonance analysis showed both soft and stiff inplane rotors to be stable. A limited evaluation of the EGR in forward flight was conducted. Due to G400 analysis limitations, the results were not sufficient to define forward flight stability and stress limits.

82N21156*# ISSUE 12 PAGE 1603 CATEGORY 2 RPT#: NASA-CR-165742 NAS 1.26:165742 CNT#: NAS1-16222 81/05/00 125 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter rotor loads using a matched asymptotic expansion technique TLSP: Final Report

AUTH: A/PIERCE, G. A.; B/VAIDYANATHAN, A. R.

CORP: Georgia Inst. of Tech., Atlanta. CSS: (School of Aerospace Engineering.) AVAIL.NTIS SAP: HC A06/MF A01

MAJS: /*ASYMPTOTIC METHODS/*HELICOPTERS/*POTENTIAL FLOW/*ROTARY WINGS/*THERMAL EXPANSION/*UNSTEADY FLOW

MINS: / AERODYNAMIC CHARACTERISTICS/ ANALYSIS (MATHEMATICS)/ NUMERICAL ANALYSIS/ SYSTEMS STABILITY

ABA: E.A.K.

ABS: The theoretical basis and computational feasibility of the Van Holten method, and its performance and range of validity by comparison with experiment and other approximate methods was examined. It is found that within the restrictions of incompressible, potential flow and the assumption of small disturbances, the method does lead to a valid description of the flow. However, the method begins to break down under conditions favoring nonlinear effects such as wake distortion and blade/rotor interaction.

82N21147*# ISSUE 12 PAGE 1602 CATEGORY 47 81/12/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Progress on low altitude cloud icing research

AUTH: A/JECK, R. K.

CORP: Naval Research Lab., Washington, D. C.; Naval Academy, Annapolis, Md. AVAIL.NTIS SAP: HC A07/MF A01

In NASA. Marshall Space Flight Center Proc.: 5th Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems p 59-63 (SEE N82-21139 12-01)

Prepared in cooperation with Naval Academy

MAJS: /*AIRFOILS/*CLOUD GLACIATION/*HELICOPTERS/*ICE PREVENTION/*LOW ALTITUDE

MINS: / CLOUDS (METEOROLOGY)/ DEICERS/ ICE FORMATION/ ICE PREVENTION/ METEOROLOGICAL PARAMETERS

ABA: E.A.K.

ABS: The icing environment at altitudes below 10,000 feet were studied. The following questions are asked, are: (1) existing aircraft certification criteria applicable; (2) too stringent on icing for helos; (3) based on accurate data; (4) appropriate for low (10,000 ft) altitudes? The research plan is outlined: review historical icing data, obtain new measurements, collect modern icing data from other groups, and recommend LWC, OAT, and MVD criteria for helicopters. Estimated accuracies and known sources of error are included. It is concluded that the net effect of possible sources of error of both signs is uncertain.

82N20561*# ISSUE 11 PAGE 1517 CATEGORY 39 RPT#: NASA-CR-165854 NAS 1.26:165854 UCLA-ENG-80-81 CNT#: NSG-1578 82/02/00 232 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of the finite element method to rotary wing aeroelasticity TLSP: Final Report

AUTH: A/STRAUB, F. K.; B/FRIEDMANN, P. P.

CORP: California Univ., Los Angeles. AVAIL.NTIS SAP: HC A11/MF A01

MAJS: /*AEROELASTICITY/*FINITE ELEMENT METHOD/*FLUTTER/*HELICOPTERS/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / AERODYNAMIC LOADS/ DEGREES OF FREEDOM/ EIGENVALUES/ EQUATIONS OF MOTION/ EQUILIBRIUM EQUATIONS/ GALERKIN METHOD/ RIGID ROTORS
ABA: A.R.H.
ABS: A finite element method for the spatial discretization of the dynamic equations of equilibrium governing rotary-wing aeroelastic problems is presented. Formulation of the finite element equations is based on weighted Galerkin residuals. This Galerkin finite element method reduces algebraic manipulative labor significantly, when compared to the application of the global Galerkin method in similar problems. The coupled flap-lag aeroelastic stability boundaries of hingeless helicopter rotor blades in hover are calculated. The linearized dynamic equations are reduced to the standard eigenvalue problem from which the aeroelastic stability boundaries are obtained. The convergence properties of the Galerkin finite element method are studied numerically by refining the discretization process. Results indicate that four or five elements suffice to capture the dynamics of the blade with the same accuracy as the global Galerkin method.

82N18159*# ISSUE 9 PAGE 1172 CATEGORY 5 CNT#: NCA2-OR565-001 81/00/00 19 PAGES UNCLASSIFIED DOCUMENT DCAF F002799
UTTL: Hover tests of a model H-force rotor
AUTH: A/VELKOFF, H. R.
CORP: Ohio State Univ., Columbus. CSS: (Dept. of Mechanical Engineering.) AVAIL.NTIS SAP: HC A99/MF A01
In DGLR Seventh European Rotorcraft and Powered Lift Aircraft Forum 19 p (SEE N82-18119 09-01)
MAJS: /*HOVERING STABILITY/*ROTARY WINGS/*ROTOR AERODYNAMICS/*VANES/*WING TIPS
MINS: / ATTITUDE STABILITY/ CONTROL SURFACES/ FIGURE OF MERIT/ FINS/ GAUGE INVARIANCE/ HELICOPTER PERFORMANCE/ HOVERING
ABA: Author
ABS: The potential of using tip vanes at the ends of helicopter rotor blades to obtain a controllable H-force is considered. The addition of vanes placed perpendicular to the blade tips can be used to obtain an inplane force. By varying the angle of the vanes, a radial force can be created which can be controllable in azimuth position. Such a force could be used to provide translational motion of the rotor and aircraft without the requirement for rotor tilting. In addition, an H-force generated at high flight speed could be used as a propulsive force in a matter similar to a propeller. The force generated by the vanes could also affect the aircraft's stability characteristics. The H-force could also modify rotor performance in hovering since they could be thought to act as a virtual shroud. Tests were run with a model rotor which has a 6 foot diameter with a 3 inch chord blade. Test data are presented on the effects of various tip-vane configurations on the hovering figure of merit. The extreme sensitivity of the performance to vane arrangement is shown.

82N17154* ISSUE 8 PAGE 1027 CATEGORY 5 RPT#: NASA-CR-166280 REPT-699-099-046 CNT#: NAS2-10772 82/01/00 72 PAGES UNCLASSIFIED DOCUMENT
UTTL: Correlating measured and predicted inplane stability characteristics for an advanced bearingless rotor TLSP: Final Report
AUTH: A/WELLER, W. H.
CORP: Textron Bell Helicopter, Fort Worth, Tex. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*AERODYNAMIC STABILITY/*AEROELASTICITY/*BEARINGLESS ROTORS/*ROTARY STABILITY
MINS: / DYNAMIC TESTS/ GROUND EFFECT (AERODYNAMICS)/ HELICOPTER PERFORMANCE/ HOVERING
ABA: T.M.
ABS: The experimental data were obtained from hover tests for a scaled model of an advanced bearingless main rotor. Both isolated rotor and ground resonance conditions were tested. Test parameters included blade built-in cone and sweep angles, rotor inplane structural damping, pitch link location and fuselage structural damping. Analytical results for the conditions tested were obtained using current Bell Helicopter analyses. In addition, variations in the analytical models were made to assess their impact on the correlation between computed and measured results. Results are presented in tabular and graphical form.

82N17152*# ISSUE 8 PAGE 1027 CATEGORY 5 RPT#: NASA-CR-166246 GER-17016 CNT#: NAS2-10777 81/07/00 286 PAGES UNCLASSIFIED DOCUMENT
UTTL: Preliminary design study of a hybrid airship for flight research
AUTH: A/BROWNING, R. G. E.
CORP: Goodyear Aerospace Corp., Akron, Ohio. AVAIL.NTIS SAP: HC A13/MF A01
MAJS: /*AERODYNAMIC CONFIGURATIONS/*AIRCRAFT DESIGN/*AIRSHIPS/*RESEARCH AIRCRAFT/*ROTORCRAFT AIRCRAFT
MINS: / CONTROL STABILITY/ COST ESTIMATES/ FEASIBILITY ANALYSIS/ FLIGHT CHARACTERISTICS/ HYBRID STRUCTURES/ STRUCTURAL DESIGN/ STRUCTURAL WEIGHT/ WIND TUNNEL TESTS
ABA: Author
ABS: The feasibility of using components from four small

helicopters and an airship envelope as the basis for a quad-rotor research aircraft was studied. Preliminary investigations included a review of candidate hardware and various combinations of rotor craft/airship configurations. A selected vehicle was analyzed to assess its structural and performance characteristics.

82N17137*# ISSUE 8 PAGE 1024 CATEGORY 3 RPT#: NASA-CR-166151 CNT#: NAS2-10404 81/08/02 203 PAGES UNCLASSIFIED DOCUMENT

UTTL: Assessment of historical and projected segments of US and World civil and military rotorcraft markets 1960 - 1990 TLSP: Contractor Report, 2 Aug. 1981

AUTH: A/YATES, W. J.

CORP: Textron Bell Helicopter, Fort Worth, Tex. AVAIL.NTIS SAP: HC A10/MF A01

MAJS: /*CIVIL AVIATION/*HELICOPTERS/*MARKET RESEARCH/* MILITARY AVIATION/*ROTORCRAFT AIRCRAFT

MINS: / ECONOMIC FACTORS/ SOCIAL FACTORS/ TECHNOLOGICAL FORECASTING/ TRENDS

ABA: Author

ABS: The future military and civil worldwide market potential for current and future rotorcraft configurations was assessed. Comparisons by region, mission, civil or military, etc., are made for both historial and forecast data. A comprehensive historical data base was utilized to determine historical and future trends. Consideration was given to socio-political, economic, and technological factors in determining future trends.

82N17121*# ISSUE 8 PAGE 1022 CATEGORY 2 RPT#: NASA-CR-166256 T-35584 CNT#: NASA ORDER A-65550B 80/09/00 31 PAGES UNCLASSIFIED DOCUMENT

UTTL: Blade planform for a quiet helicopter TLSP: Final Report

AUTH: A/RAM, D. S. J.

CORP: Hughes Helicopters, Culver City, Calif. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE REDUCTION/*ROTARY WINGS/*WING PLANFORMS

MINS: / AERODYNAMIC LOADS/ AERODYNAMIC NOISE/ BLADE SLAP NOISE/ BLADE TIPS/ HELICOPTER PERFORMANCE/ TIP SPEED/ WING PROFILES

ABA: R.J.F.

ABS: The effects of blade planform and tip speed on noise and performance for a Hughes 500 C rotor system were studied. A cursory examination of the effects of such planform shapes as regular, inverse, and no taper on the noise and performance of the rotor was conducted. It was found that a constant width wide chord planform at tower tip speed provided the best performance and lowest noise. The tapered planforms had lower performance figures due to the reduced solidity. However, some noise reductions were achieved.

82N16043*# ISSUE 7 PAGE 863 CATEGORY 1 RPT#: NASA-CR-166154 CNT#: NAS2-10690 81/03/00 140 PAGES UNCLASSIFIED DOCUMENT

UTTL: Pre-design study for a modern four-bladed rotor for the Rotor System Research Aircraft (RSRA) --- integrating the YAH-64 main rotor TLSP: Final Report

AUTH: A/HUGHES, C. W.; B/LOGAN, A. H.

CORP: Hughes Helicopters, Culver City, Calif. AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /*AH-64 HELICOPTER/*DESIGN ANALYSIS/*ROTARY WINGS/* ROTOR SYSTEMS RESEARCH AIRCRAFT/*STRUCTURAL ENGINEERING

MINS: / CIRCUIT DIAGRAMS/ COST ESTIMATES/ HELICOPTER DESIGN/ HUBS/ ROTOR AERODYNAMICS/ SYSTEMS INTEGRATION

ABA: A.R.H.

ABS: Various candidate rotor systems were compared in an effort to select a modern four-bladed rotor for the RSRA. The YAH-64 rotor system was chosen as the candidate rotor system for further development for the RSRA. The process used to select the rotor system, studies conducted to mate the rotor with the RSRA and provide parametric variability, and the development plan which would be used to implement these studies are presented. Drawings are included.

82N16042*# ISSUE 7 PAGE 863 CATEGORY 1 RPT#: NASA-CR-166153 CNT#: NAS2-10689 81/01/00 312 PAGES UNCLASSIFIED DOCUMENT

UTTL: Predesign study for a modern 4-bladed rotor for the NASA rotor systems research aircraft

AUTH: A/BISHOP, H. E.; B/BURKAM, J. E.; C/HEMINWAY, R. C.; D/KEYS, C. N.; E/SMITH, K. E.; F/SMITH, J. H.; G/STALEY, J. A.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A14/MF A01

MAJS: /*AERODYNAMICS/*HELICOPTER DESIGN/*ROTARY WINGS/* STRUCTURAL DESIGN CRITERIA/*TRADEOFFS

MINS: / AERODYNAMIC COEFFICIENTS/ AERODYNAMIC LOADS/ ECONOMIC FACTORS/ FLIGHT TESTS/ GROUND TESTS/ STRUCTURAL ANALYSIS

ABA: Author

ABS: Trade-off study results and the rationale for the final selection of an existing modern four-bladed rotor system that can be adapted for installation on the Rotor Systems Research Aircraft (RSRA) are reported. The results of the detailed integration studies, parameter change studies, and instrumentation

studies and the recommended plan for development and qualification of the rotor system is also given. Its parameter variants, integration on the RSRA, and support of ground and flight test programs are also discussed.

82N16008*# ISSUE 6 PAGE 857 CATEGORY 85 RPT#: NASA-CR-166266 CNT#: NAS2-10798 81/12/00 181 PAGES UNCLASSIFIED DOCUMENT

UTTL: Community rotorcraft air transportation benefits and opportunities TLSP: Final Report, Dec. 1981

AUTH: A/GILBERT, G. A.; B/FREUND, D. J.; C/WINICK, R. M.; D/CAFARELLI, N. J.; E/HODGKINS, R. F.; F/VICKERS, T. K.

CORP: Helicopter Association of America, Washington, D. C. AVAIL.NTIS SAP: HC A09/MF A01

MAJS: /*AIR TRANSPORTATION/*COMMUNITIES/*HELICOPTERS/* TECHNOLOGY ASSESSMENT

MINS: / HELICOPTERS/ LANDING/ MOTOR VEHICLES/ PLANNING/ RAIL TRANSPORTATION/ REGULATIONS/ SITE SELECTION/ TRANSPORTATION NETWORKS/ URBAN TRANSPORTATION/ VERTICAL TAKEOFF

ABA: R.J.F.

ABS: Information about rotorcraft that will assist community planners in assessing and planning for the use of rotorcraft transportation in their communities is provided. Information useful to helicopter researchers, manufacturers, and operators concerning helicopter opportunities and benefits is also given. Three primary topics are discussed: the current status and future projections of rotorcraft technology, and the comparison of that technology with other transportation vehicles; the community benefits of promising rotorcraft transportation opportunities; and the integration and interfacing considerations between rotorcraft and other transportation vehicles. Helicopter applications in a number of business and public service fields are examined in various geographical settings.

82N15030*# ISSUE 6 PAGE 720 CATEGORY 5 RPT#: NASA-CR-166262 D210-11819-1 CNT#: NAS2-10160 81/03/00 34 PAGES UNCLASSIFIED DOCUMENT

UTTL: XV-15 Tilt Rotor fly-by-wire collective control demonstrator development specifications TLSP: Final Report, Mar. 1981

AUTH: A/MEULENERS, R. J.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*ANALOG TO DIGITAL CONVERTERS/*FLY BY WIRE CONTROL/* PERFORMANCE TESTS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM

MINS: / AIRCRAFT CONTROL/ AXES OF ROTATION/ COMPUTER PROGRAMMING/ GROUND BASED CONTROL/ ROTARY WINGS

ABA: E.A.K.

ABS: A fly by wire system in the collective control system for XV-15 Tilt Rotor Research Aircraft was evaluated. The collective control system was selected because it requires a system tracking accuracy between right and left rotors of approximately 0.1%. The performance characteristics of the collectors axel provide typical axis control response data. The demonstrator is bread boarded as a dual system instead of the triplex system.

82N15013*# ISSUE 6 PAGE 717 CATEGORY 2 RPT#: NASA-CR-165078 CNT#: NAG2-38 81/12/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flap-lag-torsional dynamics of extensional and inextensional rotor blades in hover and in forward flight TLSP: Semiannual Progress Report, Jul. - Dec 1981

AUTH: A/CRESPODASILVA, M. R. M.

CORP: Cincinnati Univ., Ohio. CSS: (Dept. of Aerospace Engineering and Applied Mechanics.) AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*EQUATIONS OF MOTION/*HELICOPTERS/*HOVERING STABILITY /*ROTARY WINGS/*TORSIONAL STRESS

MINS: / AERODYNAMICS/ ANALYSIS (MATHEMATICS)/ DYNAMIC STABILITY/ ROTOR BLADES (TURBOMACHINERY)

ABA: L.F.M.

ABS: The differential equations describing the flap-lag-torsional motion of a flexible rotor blade including third-order nonlinearities were derived for hover and forward flight. Making use of the two boundary conditions, those equations were reduced to a set of three integro partial differential equations written in terms of the flexural deflections and the torsional variable.

82N12082*# ISSUE 3 PAGE 295 CATEGORY 9 RPT#: NASA-CR-166252 CNT#: NAS2-9741 81/09/23 67 PAGES UNCLASSIFIED DOCUMENT

UTTL: Simulator certification methods and the vertical motion simulator TLSP: Final Report

AUTH: A/SHOWALTER, T. W.

CORP: Computer Sciences Corp., Mountain View, Calif. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*CERTIFICATION/*PERFORMANCE PREDICTION/*PILOT TRAINING/*VERTICAL MOTION SIMULATORS

MINS: / CDC 7600 COMPUTER/ DISPLAY DEVICES/ EQUIPMENT SPECIFICATIONS/ FLIGHT SIMULATORS/ HELICOPTERS/ SHORT TAKEOFF AIRCRAFT/ USER REQUIREMENTS/ VERTICAL TAKEOFF AIRCRAFT

ABA: S.L.
ABS: The vertical motion simulator (VMS) is designed to simulate a variety of experimental helicopter and STOL/VTOL aircraft as well as other kinds of aircraft with special pitch and Z axis characteristics. The VMS includes a large motion base with extensive vertical and lateral travel capabilities, a computer generated image visual system, and a high speed CDC 7600 computer system, which performs aero model calculations. Guidelines on how to measure and evaluate VMS performance were developed. A survey of simulation users was conducted to ascertain they evaluated and certified simulators for use. The results are presented.

82N11859*# ISSUE 2 PAGE 260 CATEGORY 71 RPT#: NASA-CR-3470 CNT#: NAS1-15730 81/11/00 150 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter rotor trailing edge noise --- noise prediction TLSP: Final Report
AUTH: A/SCHLINKER, R. H.; B/AMIER, R. K.
CORP: United Technologies Research Center, East Hartford, Conn. AVAIL.NTIS SAP: HC A07/MF A01
Washington NASA
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE PREDICTION (AIRCRAFT)/*ROTARY WINGS/*TRAILING EDGES/*WIND TUNNEL TESTS
MINS: / AERODYNAMIC NOISE/ BOUNDARY LAYERS/ BROADBAND/ DATA ACQUISITION/ NOISE GENERATORS/ SCALING LAWS
ABA: A.R.H.
ABS: A two dimensional section of a helicopter main rotor blade was tested in an acoustic wind tunnel at close to full-scale Reynolds numbers to obtain boundary layer data and acoustic data for use in developing an acoustic scaling law and testing a first principles trailing edge noise theory. Results were extended to the rotating frame coordinate system to develop a helicopter rotor trailing edge noise prediction. Comparisons of the calculated noise levels with helicopter flyover spectra demonstrate that trailing edge noise contributes significantly to the total helicopter noise spectrum at high frequencies. This noise mechanism is expected to control the minimum rotor noise. In the case of noise radiation from a local blade segment, the acoustic directivity pattern is predicted by the first principles trailing edge noise theory. Acoustic spectra are predicted by a scaling law which includes Mach number, boundary layer thickness and observer position. Spectrum shape and sound pressure level are also predicted by the first principles theory but the analysis does not predict the Strouhal value identifying the spectrum peak.

82N11071*# ISSUE 2 PAGE 150 CATEGORY 8 RPT#: FDRL-81-7 NASA-CR-166297 CNT#: NSG-2142 81/10/00 124 PAGES UNCLASSIFIED DOCUMENT
UTTL: Aeroacoustic theory for noncompact wing-gust interaction
AUTH: A/MARTINEZ, R.; B/WIDNALL, S. E.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Dept. of Aeronautics and Astronautics.) AVAIL.NTIS SAP: HC A06/MF A01
MAJS: /*AEROACOUSTICS/*AERODYNAMIC CONFIGURATIONS/*AIRCRAFT NOISE/*AIRFOIL PROFILES/*EDGE LOADING/*GUST LOADS/*MATHEMATICAL MODELS/*ROTARY WINGS/*SUBSONIC FLOW/*THREE DIMENSIONAL FLOW/*WING LOADING
MINS: / ACOUSTIC PROPERTIES/ BLADE SLAP NOISE/ BOUNDARY VALUE PROBLEMS/ DIRECTIVITY/ INFINITE SPAN WINGS/ LEADING EDGES/ ROTARY WINGS/ SUBSONIC SPEED/ VORTICES
ABA: RJF
ABS: Three aeroacoustic models for noncompact wing-gust interaction were developed for subsonic flow. The first is that for a two dimensional (infinite span) wing passing through an oblique gust. The unsteady pressure field was obtained by the Wiener-Hopf technique; the airfoil loading and the associated acoustic field were calculated, respectively, by allowing the field point down on the airfoil surface, or by letting it go to infinity. The second model is a simple spanwise superposition of two dimensional solutions to account for three dimensional acoustic effects of wing rotation (for a helicopter blade, or some other rotating planform) and of finiteness of wing span. A three dimensional theory for a single gust was applied to calculate the acoustic signature in closed form due to blade vortex interaction in helicopters. The third model is that of a quarter infinite plate with side edge through a gust at high subsonic speed. An approximate solution for the three dimensional loading and the associated three dimensional acoustic field in closed form was obtained. The results reflected the acoustic effect of satisfying the correct loading condition at the side edge.

B1N32154*# ISSUE 23 PAGE 3151 CATEGORY 9 RPT#: NASA-CR-164829 CNT#: NGR-11-002-185 78/00/00 67 PAGES UNCLASSIFIED DOCUMENT
UTTL: Two-dimensional dynamic stall as simulated in a varying freestream
AUTH: A/PIERCE, G. A.; B/KUNZ, D. L.; C/MALONE, J. B.
CORP: Georgia Inst. of Tech., Atlanta. CSS: (School of Aerospace Engineering.) AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*AERODYNAMIC STALLING/*FREE FLOW/*HELICOPTERS/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / ANGLE OF ATTACK/ DYNAMIC STABILITY/ HARMONIC GENERATORS/ LOW SPEED WIND TUNNELS/ PITCHING MOMENTS
ABA: A.R.H.
ABS: A low speed wind tunnel equipped with a axial gust generator to simulate the aerodynamic environment of a helicopter rotor was used to study the dynamic stall of a pitching blade in an effort to ascertain to what extent harmonic velocity perturbations in the freestream affect dynamic stall. The aerodynamic moment on a two dimensional, pitching blade model in both constant and pulsating airstream was measured. An operational analog computer was used to perform on-line data reduction and plots of moment versus angle of attack and work done by the moment were obtained. The data taken in the varying freestream were then compared to constant freestream data and to the results of two analytical methods. These comparisons show that the velocity perturbations have a significant effect on the pitching moment which can not be consistently predicted by the analytical methods, but had no drastic effect on the blade stability.

81N31549*# ISSUE 22 PAGE 3067 CATEGORY 37
RPT#: NASA-CR-165375 SKF-AT81T014 CNT#: NAS3-20839
81/06/00 280 PAGES UNCLASSIFIED DOCUMENT
UTTL: Development of small bore, high speed tapered roller bearing TLSP: Final Report, May 1978 - Jun. 1981
AUTH: A/MORRISON, F. R.; B/GASSEL, S. S.; C/BOVENKERK, R. L.
CORP: SKF Industries, Inc., King of Prussia, Pa.
AVAIL.NTIS SAP: HC A13/MF A01
MAJS: /*HIGH SPEED/*ROLLER BEARINGS/*SUSPENSION SYSTEMS (VEHICLES)/*TAPERED COLUMNS/*TRANSMISSIONS (MACHINE ELEMENTS)
MINS: / HELICOPTER DESIGN/ SHAFTS (MACHINE ELEMENTS)/ STRUCTURAL DESIGN/ STRUCTURAL MEMBERS
ABA: E.A.K.
ABS: The performance of four rolling bearing configurations for use on the input pinion shaft of a proposed commercial helicopter transmission was evaluated. The performance characteristics of a high speed tapered roller bearing operating under conditions comparable to those existing at this input pinion shaft were defined. The tapered roller bearing shaft support configuration was developed for the gearbox using commercially available bearing designings. The configuration was optimized and interactive thermomechanically system analyzed. Automotive pinion quality tapered roller bearings were found to be reliable under load and speed conditions in excess of those anticipated in the helicopter transmission. However, it is indicated that the elastohydrodynamic lubricant films are inadequate.

81N31213*# ISSUE 22 PAGE 3018 CATEGORY 7 CNT#: NAS2-10722 81/00/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter propulsion system reliability and engine monitoring assessments
AUTH: A/MURPHY, J. A.
CORP: Textron Bell Helicopter, Fort Worth, Tex.
AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Lewis Res. Center Aircraft Engine Diagnostics p 311-322 (SEE N81-31196 22-07)
MAJS: /*ENGINE MONITORING INSTRUMENTS/*HELICOPTERS/*PROPULSION SYSTEM PERFORMANCE/*RELIABILITY ENGINEERING
MINS: / ACCIDENT INVESTIGATION/ ENGINE DESIGN/ FAILURE ANALYSIS/ LIFE (DURABILITY)/ MAINTAINABILITY
ABA: R.C.T.
ABS: The major short life, unreliable, and high maintenance engine and power components and subsystems in current civil helicopters were identified. Categories included both reciprocating and turbine engines, single and multiple engine configurations, single and tandem trotor vehicles, and light, medium, and heavy helicopters. The major focus was on the following parameters: accident rate data; maintenance rate data; and direct operator input.

81N29135*# ISSUE 20 PAGE 2728 CATEGORY 8 RPT#: NASA-CR-166233 ASRL-TR-196-3 CNT#: NSG-2266
81/08/00 82 PAGES UNCLASSIFIED DOCUMENT
UTTL: Testing and evaluation of a stall-flutter-suppression system for helicopter rotors using individual-blade-control
AUTH: A/QUACKENBUSH, T. R.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Aeroelastic and Structures Research Lab.)
AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*HELICOPTER DESIGN/*HELICOPTERS/*PERFORMANCE TESTS/*ROTARY WINGS/*SYSTEMS ENGINEERING
MINS: / AERODYNAMIC STALLING/ MATHEMATICAL MODELS/ OSCILLATIONS/ WIND TUNNEL TESTS
ABA: Author
ABS: The development and testing of a feedback system designed to alleviate the violent blade first torsion mode oscillations associated with stall flutter are described. The system, based on previously developed M.I.T. Individual-Blade-Control hardware, employs blade-mounted accelerometers to sense torsional oscillations and feeds back rate informaton to increase the damping of the first torsion mode. A linear model of the blade and control system dynamics is developed and is used to give qualitative and

quantitative guidance in the design process as well as to aid in analysis of experimental results. System performance in wind tunnel tests, both in hover and forward flight, is described, and evidence is given of the system's ability to provide substantial additional damping to stall-induced blade oscillations.

81N29034*# ISSUE 19 PAGE 2712 CATEGORY 85
RPT#: NASA-CR-164642 CNT#: NASW-2342 80/00/00 40 PAGES UNCLASSIFIED DOCUMENT
UTTL: NASA's aeronautics program: Systems technology and experimental program TLSP: Final Report
CORP: National Academy of Sciences - National Research Council, Washington, D. C. AVAIL.NTIS SAP: HC A03/MF A01
MAJS: /*AERONAUTICAL ENGINEERING/*NASA PROGRAMS/*OPERATIONS RESEARCH/*RESEARCH MANAGEMENT
MINS: / GOALS/ PRIORITIES/ RESEARCH AND DEVELOPMENT/ TECHNOLOGY UTILIZATION
ABA: T.M.
ABS: The appropriateness of the division of effort between the directed to the solution of near-term problems and that directed to long-term technical advances in the program is addressed. Comparisons between in-house work and out-of-house work are presented. Programs include those in: general aviation; propulsive lift; rotorcraft; avionics and flight controls; small transport aircraft; and human/vehicle systems.

81N29030*# ISSUE 19 PAGE 2712 CATEGORY 83
RPT#: NASA-CR-166151 CNT#: NAS2-10404 81/01/00 204 PAGES UNCLASSIFIED DOCUMENT
UTTL: Assessment of historical and projected segments of US and world civil and military rotorcraft markets, 1960 - 1990
AUTH: A/YATES, W. J.
CORP: Textron Bell Helicopter, Fort Worth, Tex. AVAIL.NTIS SAP: HC A10/MF A01
MAJS: /*AIRCRAFT PRODUCTION/*HELICOPTERS/*MARKET RESEARCH/*TECHNOLOGICAL FORECASTING
MINS: / CIVIL AVIATION/ GRAPHS (CHARTS)/ GROSS NATIONAL PRODUCT/ MILITARY AVIATION/ SERVICE LIFE/ TABLES (DATA)
ABA: A.R.H.
ABS: The geographic climatic, political, economic and demographic environment of 75 countries was analyzed with respect to helicopter procurement history and usage. Key environmental indicators which are variables were projected into strengths and weaknesses of U.S. technology are reviewed. The civil market sensitivity to new technology is forecast with selected premises as to vehicle life, noise standards, fuel costs, GNP expansion and traffic growth. The forecast is based on a scenario of helicopter technology improvements resulting in increased size and performance.

81N28073*# ISSUE 19 PAGE 2575 CATEGORY 4 RPT#: NASA-CR-166168 R-6316 CNT#: NASA ORDER A-80182-B 81/05/00 93 PAGES UNCLASSIFIED DOCUMENT
UTTL: Civil application of differential GPS using a single channel sequential receiver TLSP: Final Report
CORP: Magnavox Co., Torrance, Calif. AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*CHANNELS (DATA TRANSMISSION)/*CIVIL AVIATION/*GLOBAL POSITIONING SYSTEM/*RADIO NAVIGATION/*RADIO RECEIVERS/*SEQUENCING
MINS: / POSITION INDICATORS/ SATELLITE NAVIGATION SYSTEMS
ABA: E.A.K.
ABS: The Global Positioning System (GPS) and its potential for area navigation, landing, and takeoff under minimum ceilings and advanced air traffic control operation is discussed. The following topics are reported: status of the GPS system; GPS signal availability for the civil community; alternative differential GPS concepts; predicted performance enhancement achievable with differential GPS and the operational improvements which will result; and a development program to test and evaluate differential GPS concepts, performance and operational procedures applicable to helicopters. Potential benefits which will be derived from helicopter use of GPS in the differential mode are identified.

81N27076*# ISSUE 18 PAGE 2431 CATEGORY 5 RPT#: NASA-CR-165667 CNT#: NAS1-16211 81/06/00 142 PAGES UNCLASSIFIED DOCUMENT
UTTL: Total main rotor isolation system analysis
AUTH: A/HALWES, D. R.
CORP: Textron Bell Helicopter, Fort Worth, Tex. AVAIL.NTIS SAP: HC A07/MF A01
MAJS: /*ISOLATION/*ROTOR AERODYNAMICS/*ROTORS/*VIBRATION ISOLATORS
MINS: / HELICOPTERS/ VIBRATIONAL STRESS/ VIBRATORY LOADS
ABA: Author
ABS: The requirements for a preliminary design study and verification procedure for a total main rotor isolation system at n/rev are established. The system is developed and analyzed, and predesign drawings are created for an isolation system that achieves over 95 percent isolation of all six degrees of freedom.

81N26120*# ISSUE 17 PAGE 2298 CATEGORY 5 RPT#: AD-A099192 HH-80-466 DTNSRDC/ASED-81/07 CNT#: N00167-80-C-0066 WF41421091 81/03/00 43 PAGES UNCLASSIFIED DOCUMENT

UTTL: Preliminary design of a tip-jet-driven heavy lift helicopter incorporating circulation control

AUTH: A/HEAD, R. E.

CORP: Hughes Helicopters, Culver City, Calif. AVAIL.NTIS SAP: HC A03/MF A01
Bethesda, Md. DTNSRDC

MAJS: /*HEAVY LIFT HELICOPTERS/*HELICOPTER DESIGN/*LIFT/*TIP DRIVEN ROTORS

MINS: / COMPUTER PROGRAMS/ COMPUTERIZED SIMULATION/ HELICOPTER PROPELLER DRIVE

ABA: GRA

ABS: This report describes a preliminary design study for a Very Heavy Lift Helicopter (VHLH) that is powered by jets at the blade tips and is controlled by circulation control applied to the main rotor blades. The main thrust of the program was to integrate a tip-jet-powered helicopter design computer program developed by Hughes Helicopters, Inc. (HHI) with circulation control data generated by the David Taylor Naval Ship Research and Development Center (DTNSRDC). This work combined the computer program integration work with an air vehicle preliminary design study to size the helicopter and describe its features. The result of this study is the sizing of a four-engined helicopter with a 185 foot diameter, two-bladed main rotor that is designed to carry the XM-1 Main Battle Tank 100 nautical miles in a ship-to-shore Marine Corps assault mission.

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81N26034*# ISSUE 17 PAGE 2284 CATEGORY 1 RPT#: NASA-CR 164519 CNT#: NASW-3455 81/00/00 7 VOLS 185 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA's Role in Aeronautics: A Workshop. Volume 7: Background papers

CORP: National Academy of Sciences - National Research Council, Washington, D. C. CSS: (Assembly of Engineering.) AVAIL.NTIS SAP: HC A09/MF A01
Workshop held at Woods Hole, Mass., 27 Jul. - Aug. 1980

MAJS: /*AERONAUTICAL ENGINEERING/*AIRCRAFT INDUSTRY/*CIVIL AVIATION/*CONFERENCES/*GOVERNMENT/INDUSTRY RELATIONS/*NASA PROGRAMS

MINS: / AIRCRAFT FUELS/ DEFENSE PROGRAM/ FEDERAL BUDGETS/ MANPOWER/ MARKET RESEARCH

ABA: A.R.H.

ABS: The nature and implications of the current state of U.S. aviation in a world setting are examined as well as their significance for NASA's role in the nation's aeronautical future. The outlook for the 1980's is examined from the point of view of legislation, economics and finance; petroleum; manpower, metallic materials, general aviation; military aviation; transport aircraft developments; and helicopters. Possible NASA assistance to DOD and the FAA is examined and the evolution of NACA and NASA in aeronautics and of NASA's aeronautics capabilities are described.

81N26032*# ISSUE 17 PAGE 2283 CATEGORY 1 RPT#: NASA-CR-164517 CNT#: NASW-3455 NASW-2342 81/00/00 7 VOLS 39 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA's Role in Aeronautics: A Workshop. Volume 5: Rotorcraft

CORP: National Academy of Sciences - National Research Council, Washington, D. C. CSS: (Assembly of Engineering.) AVAIL.NTIS SAP: HC A03/MF A01
Workshop held at Woods Hole, Mass., 27 Jul. - 2 Aug. 1980

MAJS: /*AERONAUTICAL ENGINEERING/*CONFERENCES/*NASA PROGRAMS/*RESEARCH MANAGEMENT/*ROTARY WING AIRCRAFT

MINS: / AEROACOUSTICS/ DEICING/ EMERGENCIES/ FLIGHT CONTROL/ ROTOR AERODYNAMICS

ABA: A.R.H.

ABS: The potential roles for NASA relating to rotorcraft are reviewed. The agency's participation is delineated for each role, a rationale is provided, the current level of activity is summarized, and suggestions are given for the kinds of research still needed. In examining opportunities for the most beneficial deployment of its resources, NASA should consider societal benefits as well as the military and civil markets in formulating the role it can play to support the development of a stronger rotorcraft technology base.

81N26028*# ISSUE 17 PAGE 2283 CATEGORY 1 RPT#: NASA-CR-164513 CNT#: NASW-3455 NASW-2342 81/00/00 7 VOLS 71 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA's Role in Aeronautics: A Workshop. Volume 1: Summary

CORP: National Academy of Sciences - National Research Council, Washington, D. C. CSS: (Assembly of Engineering.) AVAIL.NTIS SAP: HC A04/MF A01
Workshop held at Woods Hole, Mass., 27 Jul. - 2 Aug. 1980

MAJS: /*AERONAUTICAL ENGINEERING/*CONFERENCES/*GOVERNMENT/INDUSTRY RELATIONS/*NASA PROGRAMS/*POLICIES/*RESEARCH MANAGEMENT

MINS: / AERODYNAMICS/ AIRCRAFT STRUCTURES/ AVIONICS/ ELECTRONIC EQUIPMENT/ HUMAN FACTORS ENGINEERING/ PROPULSION

ABA: A.R.H.
ABS: The state of the U.S. aeronautic industry and progressive changes in national priorities as reflected in federal unified budget outlays are reviewed as well as the contribution of NACA and the character and substance of U.S. aeronautical research under NASA. Eight possible roles for the future defined by NASA are examined and the extent to which the agency should carry out these activities is considered. The roles include: (1) national facilities expertise; (2) flight sciences research; (3) generic technology evolution; (4) vehicle class evolution; (5) technology demonstration; (6) prototype development; (7) technology validation; and (8) operations feasibility; How NASA's roles varies in the areas of military aviation, general aviation, transport aircraft aeronautics, rotorcraft aeronautics, engineering education, information dissemination, and cooperation with other organizations and agencies is discussed with regard to research in aerodynamics; structures and materials; propulsion; electronics and avionics; vehicle operations; and human engineering.

81N25768*# ISSUE 16 PAGE 2248 CATEGORY 71
RPT#: NASA-CR-165715 CNT#: NAS1-15740 81/04/00 75 PAGES UNCLASSIFIED DOCUMENT
UTTL: Validation of helicopter noise prediction techniques TLSP: Contractor Report, 1979 - 1981
AUTH: A/SUCCI, G. P.
CORP: Bolt, Beranek, and Newman, Inc., Cambridge, Mass. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*COMPUTER PROGRAMS/*HELICOPTERS/*NOISE (SOUND)/* PREDICTION ANALYSIS TECHNIQUES/*ROTARY WINGS
MINS: / ACOUSTICS/ NOISE INTENSITY/ PREDICTIONS/ PROVING/ ROTARY WING AIRCRAFT/ ROTORS
ABA: Author
ABS: The current techniques of helicopter rotor noise prediction attempt to describe the details of the noise field precisely and remove the empiricisms and restrictions inherent in previous methods. These techniques require detailed inputs of the rotor geometry, operating conditions, and blade surface pressure distribution. The purpose of this paper is to review those techniques in general and the Farassat/Nystrom analysis in particular. The predictions of the Farassat/Nystrom noise computer program, using both measured and calculated blade surface pressure data, are compared to measured noise level data. This study is based on a contract from NASA to Bolt Beranek and Newman Inc. with measured data from the AH-1G Helicopter Operational Loads Survey flight test program supplied by Bell Helicopter Textron.

81N25090*# ISSUE 16 PAGE 2155 CATEGORY 8 RPT#: NASA-CR-165665 SER-70471 CNT#: NAS1-16168 81/04/00 59 PAGES UNCLASSIFIED DOCUMENT
UTTL: Main rotor six degree-of-freedom isolation system analysis TLSP: Final Report
AUTH: A/EASTMAN, L. B.
CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*ATTENUATORS/*ISOLATORS/*ROTARY WINGS/*UH-60A HELICOPTER
MINS: / DEGREES OF FREEDOM/ HELICOPTER PROPELLER DRIVE/ SHOCK ABSORBERS/ SYSTEMS ANALYSIS
ABA: T.M.
ABS: The design requirements of the system have been defined and an isolator concept satisfies these requirements identified. Primary design objectives for the isolation system are 90% attenuation of all NP main rotor shaft loads at a weight penalty less than or equal to 1% of design gross weight. The configuration is sized for a UH-60A BLACK HAWK helicopter and its performance, risk, and system integration were evaluated through a series of parametric studies. Preliminary design was carried forward to insure that the design is practical and that the details of the integration of the isolator into the helicopter system are considered. Alternate ground and flight test demonstration programs necessary to verify the proposed isolator design are defined.

81N23070*# ISSUE 14 PAGE 1861 CATEGORY 5 RPT#: NASA-CR-165344 D210-11662-1 CNT#: NAS3-22384 81/05/00 116 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotorcraft aviation icing research requirements: Research review and recommendations TLSP: Final Report
AUTH: A/PETERSON, A. A.; B/DADONE, L.; C/BEVAN, A.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A06/MF A01
MAJS: /*AIRCRAFT HAZARDS/*CERTIFICATION/*ICE FORMATION/*ICE PREVENTION/*ROTARY WING AIRCRAFT/*TECHNOLOGY ASSESSMENT
MINS: / DEICING/ ENGINE INLETS/ ENVIRONMENT SIMULATION/ FLIGHT TESTS/ PROTECTION
ABA: A.R.H.
ABS: The status of rotorcraft icing evaluation techniques and ice protection technology was assessed. Recommendations are made for near and long term icing programs that describe the needs of industry. These recommended programs are based on a consensus of the major U.S. helicopter companies. Specific activities currently planned or underway by NASA, FAA and DOD are reviewed to determine relevance to the overall

research requirements. New programs, taking advantage of current activities, are recommended to meet the long term needs for rotorcraft icing certification.

81N23065*# ISSUE 14 PAGE 1861 CATEGORY 5 RPT#: NASA-CR-152336-2 D210-11569-2-VOL-2 CNT#: NAS2-10160
80/02/00 2 VOLS 65 PAGES UNCLASSIFIED DOCUMENT
UTTL: Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 2: Project planning data
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
SAP: HC A04/MF A01
MAJS: /*AIRCRAFT DESIGN/*COMPOSITE STRUCTURES/*FLY BY WIRE CONTROL/*HUBS/*PROCUREMENT/*PROJECT PLANNING/*ROTARY WINGS/*ROTORS/*WIND TUNNEL TESTS/*XV-15 AIRCRAFT
MINS: / AIRCRAFT CONSTRUCTION MATERIALS/ COST ESTIMATES/ FABRICATION/ FINANCE/ SCHEDULES/ TILT ROTOR RESEARCH AIRCRAFT PROGRAM
ABA: J.D.H.
ABS: Project planning data for a rotor and control system procurement and testing program for modifications to the XV-15 tilt-rotor research demonstrator aircraft is presented. The design, fabrication, and installation of advanced composite blades compatible with the existing hub, an advanced composite hub, and a nonmechanical control system are required.

81N23064*# ISSUE 14 PAGE 1860 CATEGORY 5 RPT#: NASA-CR-152336-1 D210-11569-1-VOL-1 CNT#: NAS2-10160
79/11/00 2 VOLS 263 PAGES UNCLASSIFIED DOCUMENT
UTTL: Preliminary design study of advanced composite blade and hub and nonmechanical control system for the tilt-rotor aircraft. Volume 1: Engineering studies TLSP: Final Report
AUTH: A/ALEXANDER, H. R.; B/SMITH, K. E.; C/MCVEIGH, M. A.; D/DIXON, P. G.; E/MCMANUS, B. L.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
SAP: HC A12/MF A01
MAJS: /*AIRCRAFT DESIGN/*COMPOSITE STRUCTURES/*FLY BY WIRE CONTROL/*HUBS/*ROTARY WINGS/*ROTORS/*XV-15 AIRCRAFT
MINS: / AERODYNAMICS/ AEROELASTICITY/ AIRCRAFT SPECIFICATIONS/ COST ESTIMATES/ DYNAMIC CHARACTERISTICS/ ENGINEERING DRAWINGS/ MECHANICAL PROPERTIES/ TILT ROTOR RESEARCH AIRCRAFT PROGRAM
ABA: Author
ABS: Composite structures technology is applied in a preliminary design study of advanced technology blades and hubs for the XV-15 tilt rotor research demonstrator aircraft. Significant improvements in XV-15 hover and cruise performance are available using blades designed for compatibility with the existing aircraft, i.e., blade installation would not require modification of the airframe, hub or upper controls. Provision of a low risk nonmechanical control system was also studied, and a development specification is given.

81N22726*# ISSUE 13 PAGE 1811 CATEGORY 61
RPT#: NASA-CR-159085 CNT#: NAS1-14549 79/11/00 54 PAGES UNCLASSIFIED DOCUMENT
UTTL: INDES User's guide multistep input design with nonlinear rotorcraft modeling
CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS
SAP: HC A04/MF A01
Sponsored in part by Army
MAJS: /*COMPUTER PROGRAMS/*INPUT/*NONLINEAR SYSTEMS/*ROTARY WING AIRCRAFT
MINS: / AERODYNAMIC CHARACTERISTICS/ ALGORITHMS/ COMPUTER PROGRAMMING/ DATA PROCESSING/ USER MANUALS (COMPUTER PROGRAMS)
ABA: M.G.
ABS: The INDES computer program, a multistep input design program used as part of a data processing technique for rotorcraft systems identification, is described. Flight test inputs base on INDES improve the accuracy of parameter estimates. The input design algorithm, program input, and program output are presented.

81N22725*# ISSUE 13 PAGE 1811 CATEGORY 61
RPT#: NASA-CR-159084 CNT#: NAS1-14549 79/11/00 29 PAGES UNCLASSIFIED DOCUMENT
UTTL: SCI model structure determination program (OSR) user's guide --- optimal subset regression
CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS
SAP: HC A03/MF A01
MAJS: /*COMPUTER PROGRAMS/*MATHEMATICAL MODELS/*REGRESSION ANALYSIS/*ROTARY WING AIRCRAFT
MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC COEFFICIENTS/ ALGORITHMS/ CORRELATION/ DATA PROCESSING / INDEPENDENT VARIABLES/ INPUT/ OUTPUT
ABA: M.G.
ABS: The computer program, OSR (Optimal Subset Regression) which estimates models for rotorcraft body and rotor force and moment coefficients is described. The technique used is based on the subset regression algorithm. Given time histories of aerodynamic coefficients, aerodynamic variables, and control inputs, the program computes correlation between various time histories. The model structure determination is based on these correlations. Inputs and outputs of the program are given.

B1N22724*# ISSUE 13 PAGE 1811 CATEGORY 61
RPT#: NASA-CR-159083 CNT#: NAS1-14549 79/11/00
121 PAGES UNCLASSIFIED DOCUMENT

UTTL: NLSCIDNT user's guide maximum likehood parameter identification computer program with nonlinear rotorcraft model

CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS SAP: HC A06/MF A01

MAJS: /*COMPUTER PROGRAMS/*MAXIMUM LIKELIHOOD ESTIMATES/* NONLINEAR SYSTEMS/*ROTARY WING AIRCRAFT

MINS: / AERODYNAMIC COEFFICIENTS/ AERODYNAMIC STABILITY/ ALGORITHMS/ COMPUTER PROGRAMMING/ FLIGHT CONTROL/ OPTIMIZATION/ USER MANUALS (COMPUTER PROGRAMS)

ABA: M.G.

ABS: A nonlinear, maximum likelihood, parameter identification computer program (NLSCIDNT) is described which evaluates rotorcraft stability and control coefficients from flight test data. The optimal estimates of the parameters (stability and control coefficients) are determined (identified) by minimizing the negative log likelihood cost function. The minimization technique is the Levenberg-Marquardt method, which behaves like the steepest descent method when it is far from the minimum and behaves like the modified Newton-Raphson method when it is nearer the minimum. Twenty-one states and 40 measurement variables are modeled, and any subset may be selected. States which are not integrated may be fixed at an input value, or time history data may be substituted for the state in the equations of motion. Any aerodynamic coefficient may be expressed as a nonlinear polynomial function of selected 'expansion variables'.

B1N22723*# ISSUE 13 PAGE 1811 CATEGORY 61
RPT#: NASA-CR-159082 CNT#: NAS1-14549 79/11/00 50 PAGES UNCLASSIFIED DOCUMENT

UTTL: SCI Identification (SCIDNT) program user's guide --- maximum likelihood method for linear rotorcraft models

CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*COMPUTER PROGRAMS/*LINEAR SYSTEMS/*MAXIMUM LIKELIHOOD ESTIMATES/*ROTARY WING AIRCRAFT

MINS: / AERODYNAMIC COEFFICIENTS/ AERODYNAMIC STABILITY/ ALGORITHMS/ COMPUTER PROGRAMMING/ FLIGHT CONTROL/ OPTIMIZATION/ USER MANUALS (COMPUTER PROGRAMS)

ABA: M.G.

ABS: The computer program Linear SCIDNT which evaluates rotorcraft stability and control coefficients from flight or wind tunnel test data is described. It implements the maximum likelihood method to maximize the likelihood function of the parameters based on measured input/output time histories. Linear SCIDNT may be applied to systems modeled by linear constant-coefficient differential equations. This restriction in scope allows the application of several analytical results which simplify the computation and improve its efficiency over the general nonlinear case.

B1N22722*# ISSUE 13 PAGE 1811 CATEGORY 61
RPT#: NASA-CR-159081 CNT#: NAS1-14549 79/11/00 69 PAGES UNCLASSIFIED DOCUMENT

UTTL: DEKFIS user's guide: Discrete Extended Kalman Filter/Smoother program for aircraft and rotorcraft data consistency

CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*COMPUTER PROGRAMS/*DATA SMOOTHING/*FIXED WINGS/* KALMAN FILTERS/*ROTARY WING AIRCRAFT

MINS: / ALGORITHMS/ COMPUTER PROGRAMMING/ ERROR CORRECTING DEVICES/ ESTIMATING/ INSTRUMENT ERRORS/ LINEARIZATION/ NONLINEAR EQUATIONS/ USER MANUALS (COMPUTER PROGRAMS)

ABA: M.G.

ABS: The computer program DEKFIS (discrete extended Kalman filter/smoother), formulated for aircraft and helicopter state estimation and data consistency, is described. DEKFIS is set up to pre-process raw test data by removing biases, correcting scale factor errors and providing consistency with the aircraft inertial kinematic equations. The program implements an extended Kalman filter/smoother using the Friedland-Duffy formulation.

B1N22047*# ISSUE 13 PAGE 1718 CATEGORY 6 RPT#: NASA-CR-152320 CNT#: NAS2-10326 80/01/00 381 PAGES UNCLASSIFIED DOCUMENT

UTTL: V/STOLAND digital avionics system for XV-15 tilt rotor TLSP: Final Report

AUTH: A/LIDEN, S.

CORP: Sperry Flight Systems, Phoenix, Ariz. AVAIL.NTIS SAP: HC A17/MF A01

MAJS: /*AUTOMATIC FLIGHT CONTROL/*AVIONICS/*DIGITAL SYSTEMS /*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*V/STOL AIRCRAFT/*XV-15 AIRCRAFT

MINS: / AIRBORNE/SPACEBORNE COMPUTERS/ AIRCRAFT GUIDANCE/ AIRCRAFT LANDING/ ARCHITECTURE (COMPUTERS)/ DISPLAY DEVICES

ABA: A.R.H.

ABS: A digital flight control system for the tilt rotor research aircraft provides sophisticated navigation, guidance, control, display and data acquisition capabilities for performing terminal area navigation, guidance and control research. All functions of the XV-15 V/STOLAND system were demonstrated on the

NASA-ARC S-19 simulation facility under a comprehensive dynamic acceptance test. The most noteworthy accomplishments of the system are: (1) automatic configuration control of a tilt-rotor aircraft over the total operating range; (2) total hands-off landing to touchdown on various selectable straight-in glide slopes and on a flight path that includes a two-revolution helix; (3) automatic guidance along a programmed three-dimensional reference flight path; (4) navigation data for the automatic guidance computed on board, based on VOR/DME, TACAN, or MLS navid data; and (5) integration of a large set of functions in a single computer, utilizing 16k words of storage for programs and data.

81N19112*# ISSUE 10 PAGE 1305 CATEGORY 6 RPT#: NASA-CR-152179 CNT#: NAS2-7306 78/10/00 216 PAGES UNCLASSIFIED DOCUMENT

UTTL: V/STOL AND digital avionics system for UH-1H TLSP: Final Report

AUTH: A/LIDEN, S.

CORP: Sperry Flight Systems, Phoenix, Ariz. AVAIL.NTIS SAP: HC A10/MF A01

MAJS: /*AREA NAVIGATION/*AVIONICS/*DIGITAL SYSTEMS/* HELICOPTER CONTROL/*MILITARY HELICOPTERS

MINS: / BELL AIRCRAFT/ COMPUTERIZED SIMULATION/ DATA ACQUISITION/ DIGITAL COMPUTERS/ DISPLAY DEVICES/ FLIGHT SIMULATION

ABA: T.M.

ABS: A hardware and software system for the Bell UH-1H helicopter was developed that provides sophisticated navigation, guidance, control, display, and data acquisition capabilities for performing terminal area navigation, guidance and control research. Two Sperry 18198 general purpose digital computers were used. One contains the development software that performs all the specified system flight computations. The second computer is available to NASA for experimental programs that run simultaneously with the other computer programs and which may, at the push of a button, replace selected computer computations. Other features that provide research flexibility include keyboard selectable gains and parameters and software generated alphanumeric and CRT displays.

81N19098*# ISSUE 10 PAGE 1302 CATEGORY 5 RPT#: NASA-CR-159297 CNT#: NAS1-14549 80/11/00 265 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of advanced techniques for rotorcraft state estimation and parameter identification

AUTH: A/HALL, W. E., JR.; B/BOHN, J. G.; C/VINCENT, J. H.

CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS SAP: HC A12/MF A01

MAJS: /*AERODYNAMIC CHARACTERISTICS/*MATHEMATICAL MODELS/* PARAMETER IDENTIFICATION/*ROTARY WING AIRCRAFT

MINS: / AEROELASTICITY/ DEGREES OF FREEDOM/ HELICOPTER DESIGN/ KALMAN FILTERS/ MAXIMUM LIKELIHOOD ESTIMATES/ ROTOR AERODYNAMICS

ABA: A.R.H.

ABS: An integrated methodology for rotorcraft system identification consists of rotorcraft mathematical modelling, three distinct data processing steps, and a technique for designing inputs to improve the identifiability of the data. These elements are as follows: (1) a Kalman filter smoother algorithm which estimates states and sensor errors from error corrupted data. Gust time histories and statistics may also be estimated; (2) a model structure estimation algorithm for isolating a model which adequately explains the data; (3) a maximum likelihood algorithm for estimating the parameters and estimates for the variance of these estimates; and (4) an input design algorithm, based on a maximum likelihood approach, which provides inputs to improve the accuracy of parameter estimates. Each step is discussed with examples to both flight and simulated data cases.

81N18028*# ISSUE 9 PAGE 1144 CATEGORY 2 RPT#: NASA-CR-152251 R-1562 CNT#: NAS2-8726 79/01/15 170 PAGES UNCLASSIFIED DOCUMENT

UTTL: Multicyclic controllable twist rotor data analysis TLSP: Final Report

AUTH: A/WEI, F. S.; B/WEISBRICH, A. L.

CORP: Kaman Aerospace Corp., Bloomfield, Conn. AVAIL.NTIS SAP: HC A08/MF A01

MAJS: /*BENDING MOMENTS/*CONTROLLABILITY/*OPTIMIZATION/* ROTARY WINGS/*ROTOR AERODYNAMICS/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC STABILITY/ BENDING VIBRATION/ HELICOPTER PERFORMANCE/ LOADING MOMENTS/ REGRESSION ANALYSIS

ABA: T.M.

ABS: Results provide functional relationship between rotor performance, blade vibratory loads and dual control settings and indicate that multicyclic control produced significant reductions in blade flatwise bending moments and blade root actuator control loads. Higher harmonic terms of servo flap deflection were found to be most pronounced in flatwise bending moment, transmission vertical vibration and pitch link vibratory load equations. The existing test hardware represents a satisfactory configuration for demonstrating MCTR technology and defining a data base for additional wind tunnel testing.

81N17831*# ISSUE 8 PAGE 1113 CATEGORY 66 RPT#:
NASA-CR-152202 CNT#: NAS2-9826 78/12/00 390 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Study of civil markets for heavy-lift airships
AUTH: A/NETTAM, P. J.; B/HANSEN, D.; C/CHABOT, C.; D/BYRNE, R.
CORP: Booz-Allen Applied Research, Inc., Bethesda, Md.
AVAIL.NTIS SAP: HC A17/MF A01
MAJS: /*DESIGN ANALYSIS/*HEAVY LIFT HELICOPTERS/*MARKET RESEARCH/*PRODUCT DEVELOPMENT/*USER REQUIREMENTS
MINS: / AIR CARGO/ ECONOMIC ANALYSIS/ HELICOPTER DESIGN/ MARKETING/ MILITARY OPERATIONS
ABA: T.M.
ABS: The civil markets for heavy lift airships (HLAs) were defined by first identifying areas of most likely application. The operational suitability of HLAs for the applications identified were then assessed. The operating economics of HLAs were established and the market size for HLA services estimated by comparing HLA operating and economic characteristics with those of competing modes. The sensitivities of the market size to HLA characteristics were evaluated and the number and sizes of the vehicles required to service the more promising markets were defined. Important characteristics for future HLAs are discussed that were derived from the study of each application, including operational requirements, features enhancing profitability, military compatibility, improved design requirements, approach to entry into service, and institutional implications for design and operation.

81N14560*# ISSUE 5 PAGE 651 CATEGORY 47
80/03/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aircraft icing instrumentation: Unfilled needs --- rotary wing aircraft
AUTH: A/KITCHENS, P. F.
CORP: Army Test and Evaluation Command, Aberdeen Proving Ground, Md. AVAIL.NTIS SAP: HC A13/MF A01
In NASA. Marshall Space Flight Center Proc: Fourth Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems p 61-65 (SEE N81-14555 05-47)
MAJS: /*ATMOSPHERIC TEMPERATURE/*ICE FORMATION/*METEOROLOGICAL PARAMETERS/*ROTARY WING AIRCRAFT
MINS: / AIRCRAFT SPECIFICATIONS/ ATMOSPHERIC MOISTURE/ DROP SIZE/ DROPS (LIQUIDS)/ SOLAR RADIATION
ABA: R.C.T.
ABS: A list of icing instrumentation requirements are presented. Because of the Army's helicopter orientation, many of the suggestions are specific to rotary wing aircraft; however, some of the instrumentation are also suitable for general aviation aircraft.

81N12110*# ISSUE 3 PAGE 307 CATEGORY 8 RPT#:
NASA-CR-152306 TR-1127-1-VOL-2 CNT#: NAS2-9946
79/03/00 254 PAGES UNCLASSIFIED DOCUMENT

UTTL: Practical optimal flight control system design for helicopter aircraft. Volume 2: Software user's guide TLSP: Final Report
AUTH: A/RIEDEL, S. A.
CORP: Systems Technology, Inc., Hawthorne, Calif.
AVAIL.NTIS SAP: HC A12/MF A01
MAJS: /*COMPUTER SYSTEMS DESIGN/*CONTROL THEORY/*FLIGHT CONTROL/*HELICOPTER CONTROL/*OPTIMAL CONTROL
MINS: / KALMAN FILTERS/ USER MANUALS (COMPUTER PROGRAMS)/ USER REQUIREMENTS
ABA: J.M.S.
ABS: A method by which modern and classical control theory techniques may be integrated in a synergistic fashion and used in the design of practical flight control systems is presented. A general procedure is developed, and several illustrative examples are included. Emphasis is placed not only on the synthesis of the design, but on the assessment of the results as well. The first step is to establish the differences, distinguishing characteristics and connections between the modern and classical control theory approaches. Ultimately, this uncovers a relationship between bandwidth goals familiar in classical control and cost function weights in the equivalent optimal system. In order to obtain a practical optimal solution, it is also necessary to formulate the problem very carefully, and each choice of state, measurement and output variable must be judiciously considered. Once design goals are established and problem formulation completed, the control system is synthesized in a straightforward manner. Three steps are involved: filter-observer solution, regulator solution, and the combination of those two into the controller. Assessment of the controller permits and examination and expansion of the synthesis results.

81N10049*# ISSUE 1 PAGE 8 CATEGORY 4 RPT#:
NASA-CR-163656 P880-809072 80/05/00 80 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Head up displays. Citations from the International Aerospace Abstracts data base TLSP: Progress Report, 1976 - Apr. 1980
AUTH: A/HIPPLER, R.
CORP: New England Research Application Center, Storrs, Conn.
AVAIL.NTIS SAP: HC $30.00/MF $30.00
Sponsored by NASA and NTIS
MAJS: /*AIRCRAFT EQUIPMENT/*BIBLIOGRAPHIES/*DISPLAY DEVICES/*ONBOARD EQUIPMENT
MINS: / FIGHTER AIRCRAFT/ HELMET MOUNTED DISPLAYS/ SYSTEMS ANALYSIS

ABA: GRA
ABS: Head up displays are the subject of this retrospective survey of much of the world aerospace literature. Design, fabrication and use, and applications to specific aircraft, such as the F-4E, Jaguar, Tornado, F-18, Viggin, A-10, AV-8B, Sea Harrier, Space Shuttle, helicopters, KC-135S, and in commercial aircraft, are discussed. A look at the future in this field is also presented. Contains 70 citations.

81N10019*# ISSUE 1 PAGE 4 CATEGORY 3 RPT#: NASA-CR-152390 FR-MTRD(CA)-80-13-VOL-2 CNT#: NAS2-10505 80/10/00 221 PAGES UNCLASSIFIED DOCUMENT
UTTL: Civil helicopter wire strike assessment study. Volume 2: Accident analysis briefs TLSP: Final Report
AUTH: A/TUOMELA, C. H.; B/BRENNAN, M. F.
CORP: Human Resources Research Organization, Alexandria, Va. AVAIL.NTIS SAP: HC A10/MF A01
MAJS: /*AIRCRAFT HAZARDS/*COLLISIONS/*HELICOPTERS/*PILOT ERROR/*ROTARY WINGS/*WIRE
MINS: / AIRCRAFT ACCIDENTS/ FLIGHT HAZARDS/ GENERAL AVIATION AIRCRAFT
ABA: T.M.
ABS: A description and analysis of each of the 208 civil helicopter wire strike accidents reported to the National Transportation Safety Board (NTSB) for the ten year period 1970-1979 is given. The accident analysis briefs were based on pilot reports, FAA investigation reports, and such accident photographs as were made available. Briefs were grouped by year and, within year, by NTSB accident report number.

80N34217*# ISSUE 24 PAGE 3348 CATEGORY 71 RPT#: NASA-CR-159339 SER-510038 80/07/00 290 PAGES UNCLASSIFIED DOCUMENT
UTTL: An evaluation of a computer code based on linear acoustic theory for predicting helicopter main rotor noise --- CH-53A and S-76 helicopters TLSP: Final Report
AUTH: A/DAVIS, S. J.; B/EGOLF, T. A.
CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS SAP: HC A13/MF A01
MAJS: /*ACOUSTICS/*COMPUTER PROGRAMS/*HELICOPTERS/*NOISE PREDICTION (AIRCRAFT)/*NUMERICAL ANALYSIS/*ROTARY WINGS
MINS: / AERODYNAMIC LOADS/ AEROELASTICITY/ DATA BASES/ PRESSURE DISTRIBUTION/ ROTOR AERODYNAMICS
ABA: A.R.H.
ABS: Acoustic characteristics predicted using a recently developed computer code were correlated with measured acoustic data for two helicopter rotors. The analysis, is based on a solution of the Ffowcs-Williams-Hawkings (FW-H) equation and includes terms accounting for both the thickness and loading components of the rotational noise. Computations are carried out in the time domain and assume free field conditions. Results of the correlation show that the Farrassat/Nystrom analysis, when using predicted airload data as input, yields fair but encouraging correlation for the first 6 harmonics of blade passage. It also suggests that although the analysis represents a valuable first step towards developing a truly comprehensive helicopter rotor noise prediction capability, further work remains to be done identifying and incorporating additional noise mechanisms into the code.

80N33398*# ISSUE 24 PAGE 3233 CATEGORY 5 RPT#: NASA-CR-3312 REPT-4300 CNT#: NAS2-10145 80/10/00 165 PAGES UNCLASSIFIED DOCUMENT
UTTL: Pilot/vehicle model analysis of visual and motion cue requirements in flight simulation --- helicopter hovering TLSP: Final Report
AUTH: A/BARON, S.; B/LANCRAFT, R.; C/ZACHARIAS, G.
CORP: Bolt, Beranek, and Newman, Inc., Cambridge, Mass. AVAIL.NTIS SAP: HC A08/MF A01 Washington NASA
MAJS: /*DIGITAL SIMULATION/*FLIGHT SIMULATION/*HELICOPTER CONTROL/*MOTION PERCEPTION/*PILOT PERFORMANCE/*VISUAL PERCEPTION
MINS: / DISPLAY DEVICES/ FIELD OF VIEW/ HOVERING/ TASK COMPLEXITY/ TIME LAG/ VISUAL TASKS
ABA: Author
ABS: The optimal control model (OCM) of the human operator is used to predict the effect of simulator characteristics on pilot performance and workload. The piloting task studied is helicopter hover. Among the simulator characteristics considered were (computer generated) visual display resolution, field of view and time delay.

80N33381*# ISSUE 24 PAGE 3231 CATEGORY 3 RPT#: NASA-CR-152389 HUMRRO-FR-MTD(CA)-80-13 CNT#: NAS2-10505 80/10/00 66 PAGES UNCLASSIFIED DOCUMENT
UTTL: Civil helicopter wire strike assessment study. Volume 1: Findings and recommendations TLSP: Final Report
AUTH: A/TUOMELA, C. H.; B/BRENNAN, M. F.
CORP: Human Resources Research Organization, Alexandria, Va. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*AIRCRAFT ACCIDENT INVESTIGATION/*CIVIL AVIATION/*HELICOPTERS/*WIRE
MINS: / COLLISION AVOIDANCE/ FLIGHT HAZARDS/ PILOT PERFORMANCE/ TRANSMISSION LINES

... civil helicopter wire strike accidents for a ten year period 1970 to 1979 are analyzed. It is found that 83% of the wire strikes occurred during bright clear weather. Analysis of the accidents is organized under pilot, environment, and machine factors. Methods to reduce the wire strike accident rate are discussed, including detection/warning devices, identification of wire locations prior to flight, wire cutting devices, and implementation of training programs. The benefits to be gained by implementing accident avoidance methods are estimated to be fully justified by reduction in injury and death and reduction of aircraft damage and loss.

80N33351*# ISSUE 24 PAGE 3227 CATEGORY 2 RPT#: NASA-CR-152366 SER-510034 CNT#: NAS2-10211
80/07/00 169 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analysis and correlation of test data from an advanced technology rotor system --- helicopter performance prediction TLSP: Final Report, Mar. 1979 - Jun. 1980
AUTH: A/JEPSON, D.; B/MOFFITT, R.; C/HILZINGER, J. B.
CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS SAP: HC A08/MF A01
MAJS: /*AEROELASTICITY/*DATA CORRELATION/*HELICOPTER PERFORMANCE/*ROTOR AERODYNAMICS/*VIBRATORY LOADS/*WIND TUNNEL TESTS
MINS: / AIRFOIL PROFILES/ BLADE TIPS/ HOVERING STABILITY/ PREDICTION ANALYSIS TECHNIQUES/ SCALE MODELS/ STIFFNESS
ABA: A.R.H.
ABS: The performance and blade vibratory loads characteristics for an advanced rotor system as predicted by analysis and as measured in a 1/5 scale model wind tunnel test, a full scale model wind tunnel test and flight test were compared. The 1/5 scale model rotor predicted conservative full scale rotor performance as expected due to Reynolds number effects. Although blade vibratory moment trends with advance ratio were predicted by the 1/5 scale model, the absolute values of the blade vibratory moments were underpredicted. The full scale model predicted forward flight performance within + or - 5%. Blade vibratory loads, however, were underpredicted. The result of rotor inflow distortions imparted by the flow over the fuselage. The coupled normal modes (Y201) elastic rotor blade analysis incorporating variable inflow was able to predict most of the trends of the test data at the higher advance ratios, but was unable to predict the absolute magnitude of the blade 1/2 peak to peak moments at all cruise speed and rotor lift conditions.

80N31408*# ISSUE 22 PAGE 2955 CATEGORY 8 RPT#: NASA-CR-163451 AD-A087201 MAE-1428 CNT#: NAS2-9437
80/01/00 104 PAGES UNCLASSIFIED DOCUMENT

UTTL: A simulator study of control and display augmentations for helicopters TLSP: Final Report
AUTH: A/ADAMSON, J. C.; B/BORN, G. J.; C/DUKES, T. A.
CORP: Princeton Univ., N. J. CSS: (Dept. of Mechanical and Aerospace Engineering.) AVAIL.NTIS SAP: HC A06/MF A01
MAJS: /*ATTITUDE INDICATORS/*DISPLAY DEVICES/*HELICOPTER CONTROL/*LANDING AIDS
MINS: / CATHODE RAY TUBES/ FLIGHT CONTROL/ FLIGHT SIMULATION / HELICOPTERS/ VISUAL AIDS
ABA: GRA
ABS: A fixed-based simulator study of a decelerating approach to hover on instruments was performed with five different control augmentation systems ranging from damping feedback to attitude command with heading-hold. On a CRT display the environment was simulated by the view of landing pad and the horizon. Superimposed on this image was all flight information needed, together with special symbology for self-contained landing aid based on airborne measurements only; there were a total of four display augmentation levels. Among other findings, the statistically significant differences in data obtained with six test pilots suggest that a relatively inexpensive addition to the display (i.e., quickening of an error rate vector with short term attitude information) makes up for the difference between rate command and attitude command control systems. A quantitative objective measure of improvements was found to suggest the major findings of the report.

80N31387*# ISSUE 22 PAGE 2950 CATEGORY 5 RPT#: NASA-TM-82272 AD-A086849 AD-E400434 ARLCD-TR-79028
CNT#: DA PROJ. 1T1-62105-A-331 80/06/00 139 PAGES UNCLASSIFIED DOCUMENT

UTTL: Progress report 3 of cooperative program for design, fabrication, and testing of high modulus composite helicopter shafting TLSP: Final Report, 1 Jan. 1975 - 30 Jun. 1979
AUTH: A/WRIGHT, C. C.; B/BAKER, D. J. PAA: A/(AARADCOM, Dover, N.J.)
CORP: Army Armament Research and Development Command, Dover, N. J. CSS: (Large Caliber Weapon Systems Lab.) AVAIL.NTIS SAP: HC A07/MF A01
MAJS: /*EPOXY RESINS/*FIBER REINFORCED COMPOSITES/*HELICOPTERS/*SHAFTS (MACHINE ELEMENTS)/*TAIL ROTORS
MINS: / CARBON FIBERS/ GLASS FIBERS/ ROTARY WINGS/ UH-1 HELICOPTER
ABA: GRA
ABS: This report describes the third phase of work, the

objective of which was to overcome the excessive brittleness of the previously developed UH-1 helicopter tail rotor drive shaft design which demonstrated a shaft train weight savings of 53.1% over the current 2024-T3 aluminum shaft train. A materials impact program demonstrated exceptionally noteworthy performance of two woven constructions containing E-glass and PRD 49-III (designation later changed to KEVLAR 49) fibers in an epoxy resin matrix. Thermoplastic matrices and PRD 49-III fiber provided impact resistance at low weight which was superior to composites having the same fiber in a thermoset resin matrix. A design, fabrication, and test program showed that shaft impact resistance could be improved over the previously developed graphite composite design at a cost in shaft train rate savings. The shaft train weight savings of the most impact tolerant construction was 4.0% over the current aluminum shaft train. Alternating plies of graphite and glass appear to provide substantially greater tube impact durability than that provided by hybridization of the two fibers into one tape wound to a ply design equivalent in strength and stiffness to that of the alternating ply design. Recommendations were made to continue research work to exploit the potential for more impact-durable structures through the use of KEVLAR 49 fiber, woven structures, thermoplastic matrices and THORNEL 50-S/KEVLAR 49 blends with thermoset matrices.

80N28369*# ISSUE 19 PAGE 2524 CATEGORY 8 RPT#: NASA-CR-152377 CNT#: NAS2-10121 80/07/00 165 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analytical design and evaluation of an active control system for helicopter vibration reduction and gust response alleviation

AUTH: A/TAYLOR, R. B.; B/ZWICKE, P. E.; C/GOLD, P.; D/MIAO, W.

CORP: United Technologies Research Center, East Hartford, Conn.; Sikorsky Aircraft, Stratford, Conn.
AVAIL.NTIS SAP: HC A08/MF A01
Prepared in cooperation with Sikorsky Aircraft, Stratford, Conn.

MAJS: /*ACTIVE CONTROL/*GUST ALLEVIATORS/*HELICOPTER CONTROL/*ROTOR AERODYNAMICS/*VIBRATION DAMPING/*WIND EFFECTS

MINS: / AIRBORNE/SPACEBORNE COMPUTERS/ REAL TIME OPERATION

ABA: E.D.K.

ABS: An analytical study was conducted to define the basic configuration of an active control system for helicopter vibration and gust response alleviation. The study culminated in a control system design which has two separate systems: narrow band loop for vibration reduction and wider band loop for gust response alleviation. The narrow band vibration loop utilizes the standard swashplate control configuration to input controller for the vibration loop is based on adaptive optimal control theory and is designed to adapt to any flight condition including maneuvers and transients. The prime characteristics of the vibration control system is its real time capability. The gust alleviation control system studied consists of optimal sampled data feedback gains together with an optimal one-step-ahead prediction. The prediction permits the estimation of the gust disturbance which can then be used to minimize the gust effects on the helicopter.

80N28330*# ISSUE 19 PAGE 2518 CATEGORY 4 RPT#: NASA-CR-152367 CNT#: NAS2-10291 80/07/00 124 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analytical methodology for determination of helicopter IFR precision approach requirements -- pilot workload and acceptance level

AUTH: A/PHATAK, A. V.

CORP: Analytical Mechanics Associates, Inc., Mountain View, Calif. AVAIL.NTIS SAP: HC A06/MF A01

MAJS: /*APPROACH CONTROL/*GLIDE PATHS/*HELICOPTER CONTROL/*INSTRUMENT FLIGHT RULES/*LANDING SIMULATION/*PILOT PERFORMANCE

MINS: / AIRCRAFT LANDING/ ALL-WEATHER LANDING SYSTEMS/ MAN MACHINE SYSTEMS/ TASK COMPLEXITY/ UH-1 HELICOPTER

ABA: Author

ABS: A systematic analytical approach to the determination of helicopter IFR precision approach requirements is formulated. The approach is based upon the hypothesis that pilot acceptance level or opinion rating of a given system is inversely related to the degree of pilot involvement in the control task. A nonlinear simulation of the helicopter approach to landing task incorporating appropriate models for UH-1H aircraft, the environmental disturbances and the human pilot was developed as a tool for evaluating the pilot acceptance hypothesis. The simulated pilot model is generic in nature and includes analytical representation of the human information acquisition, processing, and control strategies. Simulation analyses in the flight director mode indicate that the pilot model used is reasonable. Results of the simulation are used to identify candidate pilot workload metrics and to test the well known performance-work-load relationship. A pilot acceptance analytical methodology is formulated as a basis for further investigation, development and validation.

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80N27397*# ISSUE 18 PAGE 2378 CATEGORY 9 RPT#:
NASA-CR-152376 NOR 77-102-PT-1 CNT#: NAS2-9351
77/10/00 198 PAGES UNCLASSIFIED DOCUMENT
UTTL: System description and analysis. Part 1: Feasibility study for helicopter/VTOL wide-angle simulation image generation display system TLSP: Final Report
CORP: Northrop Corp., Hawthorne, Calif. CSS: (Aerosciences Lab.) AVAIL.NTIS SAP: HC A09/MF A01
Sponsored in part by Army Air Mobility and Research and Development Lab. and Ames Research Center, Mountain View, Calif.
MAJS: /*DISPLAY DEVICES/*FEASIBILITY ANALYSIS/*HELICOPTERS/* IMAGING TECHNIQUES/*VERTICAL TAKEOFF AIRCRAFT
MINS: / IMAGE CONTRAST/ IMAGE RESOLUTION
ABA: E.D.K.
ABS: A preliminary design for a helicopter/VSTOL wide angle simulator image generation display system is studied. The visual system is to become part of a simulator capability to support Army aviation systems research and development within the near term. As required for the Army to simulate a wide range of aircraft characteristics, versatility and ease of changing cockpit configurations were primary considerations of the study. Due to the Army's interest in low altitude flight and descents into and landing in constrained areas, particular emphasis is given to wide field of view, resolution, brightness, contrast, and color. The visual display study includes a preliminary design, demonstrated feasibility of advanced concepts, and a plan for subsequent detail design and development. Analysis and tradeoff considerations for various visual system elements are outlined and discussed.

80N26267*# ISSUE 17 PAGE 2219 CATEGORY 2 RPT#:
NASA-CR-2988 D210-11239-1 CNT#: NAS1-14659
78/05/00 93 PAGES UNCLASSIFIED DOCUMENT
UTTL: Design and analytical study of a rotor airfoil TLSP: Final Report
AUTH: A/DADONE, L. U.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*AIRFOILS/*HELICOPTER DESIGN/*ROTARY WINGS/* STRUCTURAL DESIGN
MINS: / DRAG/ LIFT/ LOW SPEED/ PITCHING MOMENTS
ABA: Author
ABS: An airfoil section for use on helicopter rotor blades was defined and analyzed by means of potential flow/boundary layer interaction and viscous transonic flow methods to meet as closely as possible a set of advanced airfoil design objectives. The design efforts showed that the first priority objectives, including selected low speed pitching moment, maximum lift and drag divergence requirements can be met, though marginally. The maximum lift requirement at M = 0.5 and most of the profile drag objectives cannot be met without some compromise of at least one of the higher order priorities.

80N25330*# ISSUE 16 PAGE 2086 CATEGORY 6 RPT#:
NASA-CR-3297 CNT#: NSG-1143 80/06/00 84 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Sensor for measuring instantaneous angle of attack of helicopter blades TLSP: Final Report, 13 Jan. 1975 - 31 Jul. 1979
AUTH: A/BARNA, P. S.
CORP: Old Dominion Univ., Norfolk, Va. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*ANGLE OF ATTACK/*HELICOPTERS/*ROTARY WINGS
MINS: / FLOW MEASUREMENT/ FLOW VELOCITY/ MEASURING INSTRUMENTS/ PRESSURE SENSORS
ABA: Author
ABS: Systematic investigations were performed on a variety of probes to determine their potential for possible application as sensors attached to helicopter blades to measure both the instantaneous angle of attack as well as the dynamic head during actual flight operations. After some preliminary considerations a sensor of essentially spherical shape, about 30 mm in diameter, was designed. The sensor was provided with three pressure ports, and it housed two pressure transducers required for sensing the prevailing pressures acting outside on the surface. The sensors were subsequently tested in the laboratory under a variety of flow conditions to determine their aerodynamic characteristics. Two series of tests were performed: in the first series the sensor was fixed in space while exposed to steady uniform flow, while in the second series the sensor was made to oscillate, thus simulating the cyclic pitch change of the helicopter blades. While the cyclic pitch frequencies were of about the same magnitude as encountered in flight, the flow velocities during tests fell well below those experienced in a rotating blade. The tests showed that the sensors performed satisfactorily under low subsonic flow conditions with frequencies not exceeding five Hz.

80N25323*# ISSUE 16 PAGE 2085 CATEGORY 5 RPT#:
NASA-CR-163068 PB80-153463 NMAB-351 CNT#:
MDA903-78-C-0038 79/10/00 100 PAGES UNCLASSIFIED DOCUMENT
UTTL: Materials for helicopter gears TLSP: Final Report
CORP: National Materials Advisory Board, Washington, D. C. CSS: (Commission on Sociotechnical Systems.)
AVAIL.NTIS SAP: HC A05/MF A01

Spcnsored in part by NASA and DOD
MAJS: /*EQUIPMENT SPECIFICATIONS/*FATIGUE (MATERIALS)/*GEARS /*HELICOPTER PROPELLER DRIVE/*HELICOPTERS
MINS: / FAILURE ANALYSIS/ RELIABILITY ENGINEERING/ SCORING/ STEELS
ABA: GRA
ABS: Some of the power train transmission gears in helicopter drive systems can become critical components as performance requirements are increased; accordingly, increasing attention must be paid to new alloys in order to obtain required performance reliability and survivability. Candidate advanced alloys, with improved high temperature properties, while increasing the resistance to scoring and scuffing, tend to have lower ductility and fracture toughness. An attempt is made to identify design materials, and process problems and requirements. In addition, it is recommended that the characterization of candidate steels be accelerated; preliminary investigation indicates that new alloys may provide improved capability against surface distress.

80N25100*# ISSUE 15 PAGE 2053 CATEGORY 71
RPT#: NASA-CR-159088 TM-502 CNT#: NAS1-14611
79/02/00 97 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analysis of vibratory excitation of gear systems as a contributor to aircraft interior noise --- helicopter cabin noise
AUTH: A/MARK, W. D.
CORP: Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*AIRCRAFT COMPARTMENTS/*AIRCRAFT NOISE/*GEAR TEETH/* HARMONIC ANALYSIS/*VIBRATION
MINS: / FOURIER SERIES/ GRAPHS (CHARTS)/ HELICOPTERS/ LEGENDRE FUNCTIONS/ ORTHOGONAL FUNCTIONS/ TRANSFER FUNCTIONS
ABA: A.R.H.
ABS: Application of the transfer function approach to predict the resulting interior noise contribution requires gearbox vibration sources and paths to be characterized in the frequency domain. Tooth-face deviations from perfect involute surfaces were represented in terms of Legendre polynomials which may be directly interpreted in terms of tooth-spacing errors, mean and random deviations associated with involute slope and fullness, lead mismatch and crowning, and analogous higher-order components. The contributions of these components to the spectrum of the static transmission error is discussed and illustrated using a set of measurements made on a pair of helicopter spur gears. The general methodology presented is applicable to both spur and helical gears.

80N23328*# ISSUE 14 PAGE 1804 CATEGORY 8 RPT#:
NASA-CR-3275 TR-1127-1-1 CNT#: NAS2-9946 80/05/00
273 PAGES UNCLASSIFIED DOCUMENT
UTTL: Practical optimal flight control system design for helicopter aircraft. Volume 1: Technical Report
AUTH: A/HOFMANN, L. G.; B/RIEDEL, S. A.; C/MCRUER, D.
CORP: Systems Technology, Inc., Hawthorne, Calif.
AVAIL.NTIS SAP: HC A12/MF A01
MAJS: /*FLIGHT CONTROL/*HELICOPTERS/*SYSTEMS ENGINEERING
MINS: / CONTROL THEORY/ FUNCTIONS (MATHEMATICS)/ KALMAN FILTERS/ STOCHASTIC PROCESSES/ TABLES (DATA)
ABA: R.C.T.
ABS: A method by which modern and classical theory techniques may be integrated in a synergistic fashion and used in the design of practical flight control systems is presented. A general procedure is developed, and several illustrative examples are included. Emphasis is placed not only on the synthesis of the design, but on the assessment of the results as well.

80N22357*# ISSUE 13 PAGE 1672 CATEGORY 8 RPT#:
NASA-CR-152352 ASRL-TR-196-1 CNT#: NSG-2266
80/02/00 92 PAGES UNCLASSIFIED DOCUMENT
UTTL: The design, testing and evaluation of the MIT individual-blade-control system as applied to gust alleviation for helicopters TLSP: Final Report
AUTH: A/MCKILLIP, R. M., JR.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Aeroelastic and Structures Research Lab.)
AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*GUST ALLEVIATORS/*HELICOPTER CONTROL/*LONGITUDINAL CONTROL/*ROTARY WINGS/*ROTOR AERODYNAMICS/* SERVOMECHANISMS
MINS: / ACCELEROMETERS/ EQUATIONS OF MOTION/ HARMONICS/ ROTOR SPEED/ SYSTEM EFFECTIVENESS/ WIND TUNNEL TESTS
ABA: E.D.K.
ABS: A type of active control for helicopters was designed and tested on a four foot diameter model rotor. A single blade was individually controlled in pitch in the rotating frame over a wide range of frequencies by electromechanical means. By utilizing a tip mounted accelerometer as a sensor in the feedback path, significant reductions in blade flapping response to gust were achieved at the gust excitation frequency as well as at super and subharmonics of rotor speed.

80N22305*# ISSUE 13 PAGE 1665 CATEGORY 5 RPT#: NASA-CR-152315 CNT#: NAS2-8703 80/01/00 179 PAGES UNCLASSIFIED DOCUMENT

UTTL: Parametric study of helicopter aircraft systems costs and weights

AUTH: A/BELTRAMO, M. N.

CORP: Science Applications, Inc., Los Angeles, Calif. CSS: (Economic Analysis Div.) AVAIL.NTIS SAP: HC A09/MF A01

MAJS: /*AIRCRAFT DESIGN/*AVIONICS/*HELICOPTERS/*PRODUCTION ENGINEERING

MINS: / COST ESTIMATES/ PARAMETERIZATION/ SYSTEMS ENGINEERING/ WEIGHT (MASS)

ABA: R.E.S.

ABS: Weight estimating relationships (WERs) and recurring production cost estimating relationships (CERs) were developed for helicopters at the system level. The WERs estimate system level weight based on performance or design characteristics which are available during concept formulation or the preliminary design phase. The CER (or CERs in some cases) for each system utilize weight (either actual or estimated using the appropriate WER) and production quantity as the key parameters.

80N18030*# ISSUE 9 PAGE 1092 CATEGORY 5 RPT#: NASA-CR-152310 D210-11360-1-VOL-1 CNT#: NAS2-9015 78/03/00 473 PAGES UNCLASSIFIED DOCUMENT

UTTL: A hingeless rotor XV-15 design integration feasibility study. Volume 1: Engineering design studies TLSP: Final Report

AUTH: A/MAGEE, J. P.; B/ALEXANDER, H. R.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A20/MF A01

MAJS: /*HELICOPTER DESIGN/*RIGID ROTORS/*SYSTEMS ENGINEERING /*XV-15 AIRCRAFT

MINS: / FEASIBILITY ANALYSIS/ FLIGHT CHARACTERISTICS/ FLIGHT TESTS/ NOISE REDUCTION/ STRUCTURAL DESIGN/ T-53 ENGINE

ABA: R.E.S.

ABS: A design integration feasibility study was carried out to investigate what modifications to the basic XV-15 were necessary to accomplish a flight demonstration of the XV-15 with a Boeing hingeless rotor. Also investigated were additional modifications which would exploit the full capability provided by the combination of the new rotor and the existing T53 engine. An evaluation of the aircraft is presented and the data indicate improved air vehicle performance, acceptable aeroelastic margins, lower noise levels and improved flying qualities compared with the XV-15 aircraft. Inspection of the rotor system data provided shows an essentially unlimited life rotor for the flight spectrum anticipated for the XV-15.

80N17062*# ISSUE 8 PAGE 955 CATEGORY 5 RPT#: NASA-CR-159086 ARDE-J/N-41005 CNT#: NAS1-13816 80/01/00 101 PAGES UNCLASSIFIED DOCUMENT

UTTL: Design study of prestressed rotor spar concept TLSP: Final Report, Mar. 1975 - Jun. 1976

AUTH: A/GLEICH, D.

CORP: Arde, Inc., Mahwah, N.J. AVAIL.NTIS SAP: HC A06/MF A01
Sponsored in part by the Army Aviation Res. and Develop. Command

MAJS: /*COMPOSITE STRUCTURES/*HELICOPTERS/*PRESTRESSING/* ROTOR BLADES (TURBOMACHINERY)/*STRUCTURAL DESIGN CRITERIA

MINS: / BALLISTICS/ GLASS FIBERS/ LIFE (DURABILITY)/ LIFE CYCLE COSTS/ LOAD TESTS/ METAL MATRIX COMPOSITES

ABA: M.M.M.

ABS: Studies on the Bell Helicopter 540 Rotor System of the AH-1G helicopter were performed. The stiffness, mass and geometric configurations of the Bell blade were matched to give a dynamically similar prestressed composite blade. A multi-tube, prestressed composite spar blade configuration was designed for superior ballistic survivability at low life cycle cost. The composite spar prestresses, imparted during fabrication, are chosen to maintain compression in the high strength cryogenically stretchformed 304-L stainless steel liner and tension in the overwrapped HTS graphite fibers under operating loads. This prestressing results in greatly improved crack propagation and fatigue resistance as well as enhanced fiber stiffness properties. Advantages projected for the prestressed composite rotor spar concept include increased operational life and improved ballistic survivability at low life cycle cost.

80N17061*# ISSUE 8 PAGE 954 CATEGORY 5 RPT#: NASA-CR-162754 CNT#: NSG-2375 80/02/00 46 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aerodynamic-structural analysis of dual bladed helicopter systems TLSP: Final Technical Report

AUTH: A/SELBERG, B. P.; B/CRONIN, D. L.; C/ROKHSAZ, K.; D/DYKMAN, J. R.; E/YAGER, C. J.

CORP: Missouri Univ.-Rolla. CSS: (Dept. of Mechanical and Aerospace Engineering.) AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*AERODYNAMIC CONFIGURATIONS/*HELICOPTER PROPELLER DRIVE/*ROTOR BLADES (TURBOMACHINERY)/*STRUCTURAL ANALYSIS

MINS: / AERODYNAMIC DRAG/ BOUNDARY LAYER SEPARATION/ FLOW DISTRIBUTION/ LIFTING ROTORS/ NASTRAN

ABA: A.W.H.

ABS: The aerodynamic and structural feasibility of the birotor blade concept is assessed. The inviscid flow

field about the dual, bladed rotor was investigated to determine the aerodynamic characteristics for various dual rotor blade placement combinations with respect to blade stagger, gap, and angle of attack between the two blades. The boundary layer separation on the rotors was studied and three dimensional induced drag calculations for the dual rotor system are presented. The thrust and power requirements of the rotor system were predicted. NASTRAN, employed as the primary modeling tool, was used to obtain a model for predicting in plane bending, out of plane bending, and the torsional behavior of the birotors. Local hub loads, blade loads, and the natural frequencies for the birotor configuration are discussed.

80N16070*# ISSUE 7 PAGE 824 CATEGORY 9 RPT#: NASA-CR-152193 CNT#: NAS2-9884 NASA ORDER C-4952-1 78/09/00 150 PAGES UNCLASSIFIED DOCUMENT

UTTL: Feasibility and concept study to convert the NASA/AMES vertical motion simulator to a helicopter simulator TLSP: Final Report

AUTH: A/BELSTERLING, C. A.; B/CHOU, R. C.; C/DAVIES, E. G.; D/ISUI, K. C.

CORP: Franklin Inst. Research Labs., Philadelphia, Pa. AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /*FLIGHT SIMULATORS/*HELICOPTERS/*MOTION SIMULATORS/* VERTICAL MOTION

MINS: / DEGREES OF FREEDOM/ ENGINEERING DRAWINGS/ FEASIBILITY ANALYSIS/ SYSTEMS ENGINEERING/ VERTICAL FLIGHT

ABA: R.E.S.

ABS: The conceptual design for converting the vertical motion simulator (VMS) to a multi-purpose aircraft and helicopter simulator is presented. A unique, high performance four degrees of freedom (DOF) motion system was developed to permanently replace the present six DOF synergistic system. The new four DOF system has the following outstanding features: (1) will integrate with the two large VMS translational modes and their associated subsystems; (2) can be converted from helicopter to fixed-wing aircraft simulation through software changes only; (3) interfaces with an advanced cab/visual display system of large dimensions; (4) makes maximum use of proven techniques, convenient materials and off-the-shelf components; (5) will operate within the existing building envelope without modifications; (6) can be built within the specified weight limit and avoid compromising VMS performance; (7) provides maximum performance with a minimum of power consumption; (8) simple design minimizes coupling between motions and maximizes reliability; and (9) can be built within existing budgetary figures.

80N11862*# ISSUE 2 PAGE 255 CATEGORY 66 RPT#: NASA-CR-162436 CNT#: NSG-1519 79/11/00 31 PAGES UNCLASSIFIED DOCUMENT

UTTL: A summary of spectral synthesis procedures for multivariable systems TLSP: Final Report, 1 May 1978 - 15 Sep. 1979

AUTH: A/LIBERTY, S. R.; B/MIELKE, R. R.; C/MAYNARD, R. A.

CORP: Old Dominion Univ., Norfolk, Va. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*ADAPTIVE CONTROL/*CONTROL THEORY/*EIGENVALUES/* EIGENVECTORS/*SPECTRUM ANALYSIS

MINS: / FEEDBACK CONTROL/ HELICOPTER CONTROL/ MATRICES (MATHEMATICS)/ NULL ZONES

ABA: Author

ABS: A new approach to the eigensystem assignment problem is presented. The approach utilizes a null-space formulation of the eigenvalue/eigenvector assignment problem to simultaneously realize arbitrary eigenvalue specifications, approximate desired modal behavior, and achieve low eigensystem sensitivity with respect to plant parameter variations. The methods are applied to the design of regulator and integral plus proportional servo control systems.

80N11097*# ISSUE 2 PAGE 153 CATEGORY 8 RPT#: NASA-CR-3144 TR-1087-1 CNT#: NAS2-9344 79/08/00 387 PAGES UNCLASSIFIED DOCUMENT

UTTL: A compilation and analysis of helicopter handling qualities data. Volume 1: Data compilation TLSP: Report, Sep. 1976 - Feb. 1978

AUTH: A/HEFFLEY, R. K.; B/JEWELL, W. F.; C/LEHMAN, J. M.; D/VANWINKLE, R. A.

CORP: Systems Technology, Inc., Mountain View, Calif. AVAIL.NTIS SAP: HC A17/MF A01

MAJS: /*BO-105 HELICOPTER/*FLIGHT CHARACTERISTICS/*H-53 HELICOPTER/*HELICOPTER CONTROL/*OH-6 HELICOPTER/*UH-1 HELICOPTER

MINS: / AERODYNAMICS/ AIRCRAFT DESIGN/ DEGREES OF FREEDOM/ EQUATIONS OF MOTION/ FLIGHT CONDITIONS/ STABILITY DERIVATIVES/ TRANSFER FUNCTIONS

ABA: R.C.T.

ABS: A collection of basic descriptive data, stability derivatives and transfer functions for six degrees of freedom, quasi-static model is introduced. The data are arranged in a common, compact format for each of the five helicopters represented. The vehicles studied include the BO-105, AH-1h, and the CH53D.

80N10137*# ISSUE 1 PAGE 17 CATEGORY 2 RPT#: NASA-CR-162400 CNT#: NSG-2245 79/03/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: Math modeling and computer mechanization for real time simulation of rotary-wing aircraft TLSP: Final Report, 1 Jun. 1977 - 31 Mar. 1979

AUTH: A/HOWE, R. M.

CORP: Michigan Univ., Ann Arbor. CSS: (Dept. of Aerospace Engineering.) AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*DIGITAL SIMULATION/*MATHEMATICAL MODELS/*REAL TIME OPERATION/*ROTARY WING AIRCRAFT

MINS: / COMPUTER TECHNIQUES/ CONTROLLABILITY/ HELICOPTER DESIGN/ ROTARY WINGS/ ROTOR AERODYNAMICS

ABA: A.W.H.

ABS: Mathematical modeling and computer mechanization for real time simulation of rotary wing aircraft is discussed. Error analysis in the digital simulation of dynamic systems, such as rotary wing aircraft is described. The method for digital simulation of nonlinearities with discontinuities, such as exist in typical flight control systems and rotor blade hinges, is discussed.

79N34094*# ISSUE 24 PAGE 3295 CATEGORY 83 RPT#: NASA-CR-163091 TR-1342 CNT#: NASW-2961 78/07/03 170 PAGES UNCLASSIFIED DOCUMENT

UTTL: World helicopter market study

AUTH: A/CLEARY, G.; B/PEARSON, R. W.; C/GREENWOOD, S. W.; D/KAPLAN, L.

CORP: Operations Research, Inc., Bethesda, Md. AVAIL.NTIS SAP: HC A08/MF A01

MAJS: /*AIRCRAFT INDUSTRY/*COMMERCE/*ECONOMICS/*FOREIGN TRADE/*HELICOPTERS/*MARKETING

MINS: / AIRCRAFT PRODUCTION/ COMMERCIAL AIRCRAFT/ GRAPHS (CHARTS)/ MILITARY AIRCRAFT/ TABLES (DATA)

ABA: A.R.H.

ABS: The extent of the threat to the US helicopter industry posed by a determined effort by foreign manufacturers, European companies in particular, to supply their own domestic markets and also to penetrate export markets, including the USA is assessed. Available data on US and world markets for civil and military uses are collated and presented in both graphic and tabular form showing the past history of production and markets and, where forecasts are available, anticipated future trends. The data are discussed on an item-by-item basis and inferences are drawn in as much depth as appears justified.

79N32551*# ISSUE 23 PAGE 3092 CATEGORY 37 RPT#: NASA-CR-159622 LYC-79-25 CNT#: NAS3-20795 79/06/00 62 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of spiral-groove self-acting seals for helicopter engines TLSP: Final Report, 10 Jun. 1977 - 31 Dec. 1978

AUTH: A/OBRIEN, M.

CORP: Avco Lycoming Div., Stratford, Conn. AVAIL.NTIS SAP: HC A04/MF A01

Sponsored in part by Army Res. and Technol. Labs.

MAJS: /*ENGINE PARTS/*HELICOPTER ENGINES/*SEALS (STOPPERS)

MINS: / GAS TURBINES/ GROOVES/ SPIRALS/ WEAR TESTS

ABA: F.O.S.

ABS: A spiral-groove, self-acting face seal was rig tested at advanced gas turbine operating conditions to determine wear and leakage rates. The spiral-groove, self-acting geometry was located in the rotating seal seat. Seal component wear induced by start-stop operation was measured after subjecting the test seal to 176 start-stop cycles. Wear occurring during normal operation was documented throughout a 75-hour endurance test. Seal air leakage was also measured. During endurance operation, the seal was subjected to operating conditions bounded by the values surface speed - 244 m/s (800 ft/sec), air pressure - 148 N/sq cm abs (215 psia), and air temperature - 622 K (660 F). The post-test condition of the seal components was documented. Wear data is presented in tabular form, while seal air leakage is presented graphically, as a function of pressure and speed.

79N32054*# ISSUE 22 PAGE 3020 CATEGORY 71 RPT#: NASA-CR-159118 CNT#: NAS1-15226 79/07/00 91 PAGES UNCLASSIFIED DOCUMENT

UTTL: Study of design constraints on helicopter noise

AUTH: A/STERNFELD, H., JR.; B/WIEDERSUM, C. W.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*AERODYNAMIC NOISE/*AIRCRAFT NOISE/*HELICOPTER DESIGN /*NOISE GENERATORS/*PREDICTIONS/*ROTARY WINGS

MINS: / DATA BASES/ GRAPHS (CHARTS)/ HARMONICS/ PREDICTIONS/ ROTOR AERODYNAMICS/ SOUND PRESSURE

ABA: A.R.H.

ABS: A means of estimating the noise generated by a helicopter main rotor using information which is generally available during the preliminary design phase of aircraft development is presented. The method utilizes design charts and tables which do not require an understanding of acoustical theory or computational procedures in order to predict the perceived noise level, a weighted sound pressure level, or C weighted sound pressure level of a single hovering rotor. A method for estimating the effective perceived noise

level in forward flight is also included. In order to give the designer an assessment of the relative rotor performance, which may be traded off against noise, an additional chart for estimating the percent of available rotor thrust which must be expended in lifting the rotor and drive system, is included as well as approach for comparing the subjective acceptability of various rotors once the absolute sound pressure levels are predicted.

79N31603*# ISSUE 22 PAGE 2960 CATEGORY 37
RPT#: NASA-CR-3155 MTI-78TR41 CNT#: NAS3-16824
79/08/00 158 PAGES UNCLASSIFIED DOCUMENT

TTL: Design and application of a test rig for super-critical power transmission shafts TLSP: Final Report
AUTH: A/DARLOW, M.; B/SHALLEY, A.
CORP: Mechanical Technology Inc., Latham, N. Y.
AVAIL.NTIS SAP: HC 8/MF A01
Washington NASA
MAJS: /*SHAFTS (MACHINE ELEMENTS)/*STRUCTURAL DESIGN/*TEST EQUIPMENT/*TEST FACILITIES
MINS: / DAMPING/ FEASIBILITY/ HELICOPTERS/ MECHANICAL DRIVES / POWER TRANSMISSION/ TORQUE/ UTILIZATION/ VIBRATION
ABA: G.Y.
ABS: The design, assembly, operational check-out and application of a test facility for testing supercritical power transmission shafts under realistic conditions of size, speed and torque are described. Alternative balancing methods and alternative damping mechanisms are demonstrated and compared. The influence of torque upon the unbalance distribution is studied, and its effect on synchronous vibrations is investigated. The feasibility of operating supercritical power transmission shafting is demonstrated, but the need for careful control, by balancing and damping, of synchronous and nonsynchronous vibrations is made clear. The facility was demonstrated to be valuable for shaft system development programs and studies for both advanced and current-production hardware.

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79N31222*# ISSUE 22 PAGE 2907 CATEGORY 8 RPT#:
NASA-CR-3145 TR-1087-2-VOL-2 CNT#: NAS2-9344
79/08/00 176 PAGES UNCLASSIFIED DOCUMENT

UTTL: A compilation and analysis of helicopter handling qualities data. Volume 2: Data analysis
AUTH: A/HEFFLEY, R. K.
CORP: Systems Technology, Inc., Mountain View, Calif.
AVAIL.NTIS SAP: HC A09/MF A01
MAJS: /*AIRCRAFT MANEUVERS/*CONTROLLABILITY/*HELICOPTER CONTROL/*HELICOPTER PERFORMANCE/*HELICOPTERS/*MANUAL CONTROL/*PILOT PERFORMANCE
MINS: / ATMOSPHERIC TURBULENCE/ DIRECTIONAL STABILITY/ HOVERING STABILITY/ LATERAL CONTROL/ LONGITUDINAL CONTROL/ PITCH (INCLINATION)/ ROLL/ WIND SHEAR/ YAW
ABA: A.W.H.
ABS: A compilation and an analysis of helicopter handling qualities data are presented. Multiloop manual control methods are used to analyze the descriptive data, stability derivatives, and transfer functions for a six degrees of freedom, quasi static model. A compensatory loop structure is applied to coupled longitudinal, lateral and directional equations in such a way that key handling qualities features are examined directly.

79N31221*# ISSUE 22 PAGE 2907 CATEGORY 8 RPT#:
NASA-CR-159052 HONEYWELL-79SRC33 CNT#: NAS1-14789
79/07/00 171 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter high gain control TLSP: Final Report
AUTH: A/CUNNINGHAM, T. B.; B/NUNN, E. C.
CORP: Honeywell Systems and Research Center, Minneapolis, Minn. AVAIL.NTIS SAP: HC A08/MF A01
MAJS: /*CH-47 HELICOPTER/*CONTROL EQUIPMENT/*CONTROL THEORY /*FEEDBACK CONTROL/*FLIGHT CONTROL/*HELICOPTER CONTROL /*HIGH GAIN
MINS: / ACTUATORS/ AIRCRAFT MODELS/ AIRCRAFT NOISE/ ATTITUDE CONTROL/ BANDWIDTH/ CONTROL MOMENT GYROSCOPES/ HELICOPTER PERFORMANCE/ NOISE REDUCTION/ ROTARY WINGS
ABA: A.W.H.
ABS: High gain control is explored through a design study of the CH-47B helicopter. The plans are designed to obtain the maximum bandwidth possible given the hardware constraints. Controls are designed with modal control theory to specific bandwidths and closed loop mode shapes. Comparisons are made to an earlier complementary filter approach. Bandwidth improvement by removal of limitations is explored in order to establish hardware and mechanization options. Improvements in the pitch axis control system and in the rate gyro sensor noise characteristics in all axes are discussed. The use of rotor state feedback is assessed.

79N30138*# ISSUE 21 PAGE 2761 CATEGORY 1 RPT#:
NASA-CR-152291 CNT#: NAS2-9143 79/08/00 34 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Maintenance cost study of rotary wing aircraft, phase 2 TLSP: Interim Report
CORP: Rail Co., Baltimore, Md. AVAIL.NTIS SAP: HC A03/MF A01
MAJS: /*AIRCRAFT MAINTENANCE/*COST ESTIMATES/*MILITARY HELICOPTERS/*ROTARY WING AIRCRAFT/*VERTICAL TAKEOFF

AIRCRAFT
MINS: / CORRELATION COEFFICIENTS/ PREDICTION ANALYSIS TECHNIQUES/ REGRESSION ANALYSIS/ SYSTEMS ANALYSIS
ABA: A.R.H.
ABS: The Navy's maintenance and materials management data base was used in a study to determine the feasibility of predicting unscheduled maintenance costs for the dynamic systems of military rotary wing aircraft. The major operational and design variables were identified and the direct maintenance man hours per flight hour were obtained by step-wise multiple regression analysis. Five nonmilitary helicopter users were contacted to supply data on which variables were important factors in civil applications. These uses included offshore oil exploration and support, police and fire department rescue and enforcement, logging and heavy equipment movement, and U.S. Army military operations. The equations developed were highly effective in predicting unscheduled direct maintenance man hours per flying hours for military aircraft, but less effective for commercial or public service helicopters, probably because of the longer mission durations and the much higher utilization of civil users.

79N28984*# ISSUE 19 PAGE 2606 CATEGORY 71
RPT#: NASA-CR-158844 AD-A068180 ARO-12931.2-EX
REPT-83852-1 REPT-78-1 CNT#: NSG-2095
DAAG29-76-C-0027 79/01/00 158 PAGES UNCLASSIFIED DOCUMENT
UTTL: Experimental and theoretical studies on model helicopter rotor noise TLSP: Interim Report, Mar. 1976 - Dec. 1977
AUTH: A/ARAVAMUDAN, K. S.; B/HARRIS, W. L.
CORP: Massachusetts Inst. of Tecn., Cambridge. CSS: (Fluid Dynamics Research Lab.) AVAIL.NTIS SAP: HC A08/MF A01
Submitted for publication
MAJS: /*AERODYNAMIC NOISE/*COMPUTERIZED SIMULATION/*HELICOPTERS/*ROTARY WINGS/*ROTOR AERODYNAMICS
MINS: / ANECHOIC CHAMBERS/ FLOW DISTRIBUTION/ SCALING LAWS/ TURBULENCE/ VORTICES/ WIND TUNNEL MODELS
ABA: GRA
ABS: A simplified Mach number scaling law is obtained for rotational and broadband noise components of a model helicopter rotor. The broadband noise sources are further classified into low frequency and high frequency components. The scaling laws are based on the geometric and performance parameters of the rotor and characteristics of the flow field. The existing theory of Lowson and Ollerhead is used deriving the conventional sixth power law for the rotational noise of geometrically similar blades operating in similar flow environments. The knowledge of unsteady aerodynamics was exploited to yield analytical formulation for the low frequency broadband radiation. The ambiguous state of the art regarding the origin and nature of high frequency broadband noise does not permit such a straightforward scaling law for this frequency regime. Vortices are assumed to be shed at unknown Strouhal frequency and the scaling law is derived by simply integrating the blade sectional velocity over the span. The MIT 5 x 7-1/2 foot anechoic wind tunnel was used to perform experiments at controlled flow environ. Turbulence was generated at the inlet of the tunnel and simultaneous measurements of acoustic and turbulence signals were made. The experimentally obtained results are compared with the computed intensities and spectra of rotational noise, low frequency broadband noise and high frequency broadband noise from model rotors.

79N27125*# ISSUE 18 PAGE 2362 CATEGORY 5 RPT#: NASA-CR-158778 TR-1441 CNT#: NSG-2181 79/07/00 176 PAGES UNCLASSIFIED DOCUMENT
UTTL: The influence of feedback on the aeroelastic behavior of tilt proprotor aircraft including the effects of fuselage motion TLSP: Final Technical Report, 1 Sep. 1976 - 31 Jan. 1978
AUTH: A/CURTISS, H. C., JR.; B/KOMATSUZAKI, T.; C/TRAYBAR, J. J.
CORP: Princeton Univ., N. J. CSS: (Dept. of Mechanical and Aerospace Engineering) AVAIL.NTIS SAP: HC A09/MF A01
MAJS: /*AEROELASTICITY/*FEEDBACK/*HELICOPTERS/*TILTED PROPELLERS
MINS: / AERODYNAMIC STABILITY/ AUTOMATIC CONTROL/ DYNAMIC MODELS/ EQUATIONS OF MOTION/ FUSELAGES/ ROTARY WINGS/ TRANSFER FUNCTIONS
ABA: S.E.S.
ABS: The influence of single loop feedbacks to improve the stability of the system are considered. Reduced order dynamic models are employed where appropriate to promote physical insight. The influence of fuselage freedom on the aeroelastic stability, and the influence of the airframe flexibility on the low frequency modes of motion relevant to the stability and control characteristics of the vehicle were examined.

79N26046*# ISSUE 17 PAGE 2220 CATEGORY 5 RPT#: NASA-CR-158938 CNT#: NAS1-15153 79/05/00 231 PAGES UNCLASSIFIED DOCUMENT

UTTL: System design requirements for advanced rotary-wing agricultural aircraft

AUTH: A/LEMONT, H. E.

CORP: Textron Bell Helicopter, Fort Worth, Tex.
AVAIL.NTIS SAP: HC A11/MF A01

MAJS: /*AGRICULTURAL AIRCRAFT/*CROP DUSTING/*ROTARY WINGS/* SYSTEMS ENGINEERING

MINS: / BOOMS (EQUIPMENT)/ DISPERSIONS/ ECONOMIC ANALYSIS/ HELICOPTER PERFORMANCE/ LIFT DEVICES/ OPERATIONAL PROBLEMS/ REQUIREMENTS/ WEIGHT ANALYSIS

ABA: S.E.S.

ABS: Helicopter aerial dispersal systems were studied to ascertain constraints to the system, the effects of removal of limitations (technical and FAA regulations), and subsystem improvements. Productivity indices for the aircraft and swath effects were examined. Typical missions were formulated through conversations with operators, and differing gross weight aircraft were synthesized to perform these missions. Economic analysis of missions and aircraft indicated a general correlation of small aircraft (3000 lb gross weight) suitability for small fields (25 acres), and low dispersion rates (less than 32 lb/acre), with larger aircraft (12,000 lb gross weight) being more favorable for bigger fields (200 acres) and heavier dispersal rates (100 lb/acre). Operator problems, possible aircraft and system improvements, and selected removal of operating limitations were reviewed into recommendations for future NASA research items.

79N25392*# ISSUE 16 PAGE 2132 CATEGORY 37 RPT#: NASA-CR-159586 MIT-79-TR-29 CNT#: NAS3-18520 79/02/00 45 PAGES UNCLASSIFIED DOCUMENT

UTTL: T700 power turbine rotor multiplane/multispeed balancing demonstration

AUTH: A/BURGESS, G.; B/RIO, R.

CORP: Mechanical Technology, Inc., Latham, N. Y.
AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*AERODYNAMIC BALANCE/*ROTOR AERODYNAMICS/*ROTOR SPEED /*TURBOSHAFTS/*VIBRATION DAMPING

MINS: / CENTRIFUGAL FORCE/ HELICOPTER CONTROL/ HIGH SPEED/ LOW SPEED/ PRODUCTION ENGINEERING

ABA: Author

ABS: Research was conducted to demonstrate the ability of influence coefficient based multispeed balancing to control rotor vibration through bending criticals. Rotor dynamic analyses were conducted of the General Electric T700 power turbine rotor. The information was used to generate expected rotor behavior for optimal considerations in designing a balance rig and a balance technique. The rotor was successfully balanced 9500 rpm. Uncontrollable coupling behavior prevented observations through the 16,000 rpm service speed. The balance technique is practical and with additional refinement it can meet production standards.

79N23919*# ISSUE 15 PAGE 1926 CATEGORY 2 79/00/00 27 PAGES UNCLASSIFIED DOCUMENT

UTTL: Overview of helicopter ice protection system developments

AUTH: A/ADAMS, R. I.

CORP: Army Research and Technology Labs., Fort Eustis, Va.
CSS: (Applied Technology Lab.) AVAIL.NTIS SAP: HC A07/MF A01
In NASA. Lewis Res. Center Aircraft Icing p 39-65 (SEE N79-23912 15-02)

MAJS: /*AIRCRAFT HAZARDS/*HELICOPTERS/*ICE FORMATION/* TECHNOLOGY ASSESSMENT

MINS: / EQUIPMENT SPECIFICATIONS/ ICE PREVENTION/ ROTARY WINGS/ THERMOELECTRICITY

ABA: M.M.M.

ABS: Helicopter ice protection design criteria was developed and technological shortcoming in meeting helicopter mission requirements is that of helicopter rotor blade ice protection. Airframe components are protected using existing technology while the rotor blade protected using the cyclic electrothermal deicing concept.

79N23917*# ISSUE 15 PAGE 1926 CATEGORY 2 79/00/00 2 PAGES UNCLASSIFIED DOCUMENT

UTTL: Civil Helicopter icing problems

AUTH: A/SWEENEY, P. B.

CORP: RCA Flight Operations, Trenton N. J.
AVAIL.NTIS SAP: HC A07/MF A01
In NASA. Lewis Res. Center Aircraft Icing p 29-30 (SEE N79-23912 15-02)

MAJS: /*AIRCRAFT HAZARDS/*CIVIL AVIATION/*HELICOPTERS/*ICE FORMATION

MINS: / AIRCRAFT MAINTENANCE/ DEICERS/ EQUIPMENT SPECIFICATIONS/ WEATHER FORECASTING

ABA: M.M.M.

ABS: The ice capabilities of rotary wing aircraft are examined. Recommendations are given to improve the inadequacies of the weather forecasts pertaining to ice, and to adopt a low maintenance anti-ice system.

79N23064*# ISSUE 14 PAGE 1802 CATEGORY 5 RPT#: NASA-CR-159033 CNT#: NAS1-15078 79/05/00 75 PAGES UNCLASSIFIED DOCUMENT

UTTL: Correlation study between vibrational environmental and failure rates of civil helicopter components

AUTH: A/ALANIZ, O.

CORP: Textron Bell Helicopter, Fort Worth, Tex. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*AIRCRAFT EQUIPMENT/*AIRCRAFT MAINTENANCE/*FAILURE ANALYSIS/*HELICOPTERS/*VIBRATION

MINS: / AIRCRAFT INSTRUMENTS/ ELECTRIC EQUIPMENT/ STRESS ANALYSIS/ STRUCTURAL RELIABILITY

ABA: M.M.M.

ABS: An investigation of two selected helicopter types, namely, the Models 206A/B and 212, is reported. An analysis of the available vibration and reliability data for these two helicopter types resulted in the selection of ten components located in five different areas of the helicopter and consisting primarily of instruments, electrical components, and other noncritical flight hardware. The potential for advanced technology in suppressing vibration in helicopters was assessed. The are still several unknowns concerning both the vibration environment and the reliability of helicopter noncritical flight components. Vibration data for the selected components were either insufficient or inappropariate. The maintenance data examined for the selected components were inappropriate due to variations in failure mode identification, inconsistent reporting, or inaccurate informaton.

79N22541*# ISSUE 13 PAGE 1727 CATEGORY 39 79/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Design and development of a motion compensator for the RSRA main rotor control

AUTH: A/JEFFREY, P.; B/HUBER, R.

CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS SAP: HC A13/MF A01

In NASA. Johnson Space Center The 13th Aerospace Mech. Symp. p 15-25 (SEE N79-22539 13-39)

MAJS: /*ROTARY WINGS/*ROTOR SYSTEMS RESEARCH AIRCRAFT/*SPRINGS (ELASTIC)/*TRANSMISSIONS (MACHINE ELEMENTS)/*VIBRATION ISOLATORS

MINS: / AERONAUTICAL ENGINEERING/ CONTROL THEORY/ FUSELAGES/ LINKAGES/ MECHANICAL DEVICES

ABA: J.M.S.

ABS: The RSRA, an experimental helicopter, is equipped with an active isolation system that allows the transmission to move relative to the fuselage. The purpose of the motion compensator is to prevent these motions from introducing unwanted signals to the main rotor control. A motion compensator concept was developed that has six-degree-of-freedom capability. The mechanism was implemented on RSRA and its performance verified by ground and flight tests.

79N22076*# ISSUE 13 PAGE 1664 CATEGORY 5 RPT#: NASA-CR-152258 D210-11193-1 CNT#: NAS2-10040 79/05/00 84 PAGES UNCLASSIFIED DOCUMENT

UTTL: Identification of high payoff research for more efficient applicator helicopters in agriculture and forestry

AUTH: A/WATERS, K. T.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A06/MF A01

MAJS: /*AGRICULTURE/*COST ANALYSIS/*FORESTS/*HELICOPTERS/*TECHNOLOGY UTILIZATION

MINS: / CROP GROWTH/ PROBLEM SOLVING/ SYSTEMS ENGINEERING

ABA: Author

ABS: The results of a study of the uses of helicopters in agriculture and forestry in the United States are discussed. Comparisons with agricultural airplanes are made in terms of costs of aerial application to the growers. An analysis of cost drivers and potential improvements to helicopters that will lower costs is presented. Future trends are discussed, and recommendations for research are outlined. Operational safety hazards and accident records are examined, and problem areas are identified. Areas where research and development are needed to provide opportunities for lowering costs while increasing productivity are analyzed.

79N22039*# ISSUE 13 PAGE 1657 CATEGORY 2 RPT#: NASA-CR-3082 CNT#: NAS2-7007 79/01/00 302 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotary-wing aerodynamics. Volume 1: Basic theories of rotor aerodynamics with application to helicopters --- momentum, vortices, and potential theory

AUTH: A/STEPNIEWSKI, W. Z.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A14/MF A01

Washington NASA

MAJS: /*HELICOPTERS/*MOMENTUM THEORY/*POTENTIAL THEORY/*ROTARY WINGS/*ROTOR AERODYNAMICS/*VORTICES

MINS: / AIRFOIL PROFILES/ COMPRESSIBILITY/ HOVERING/ ROTOR SPEED/ UNSTEADY FLOW/ VISCOSITY

ABA: A.R.H.

ABS: The concept of rotary-wing aircraft in general is defined. The energy effectiveness of helicopters is compared with that of other static thrust generators in hover, as well as with various air and ground vehicles in forward translation. The most important aspects of rotor-blade dynamics and rotor control are

reviewed. The simple, physicomathematical model of the rotor offered by the momentum theory is introduced and its usefulness and limitations are assessed. The combined blade-element and momentum theory approach, which provides greater accuracy in performance predictions, is described as well as the vortex theory which models a rotor blade by means of a vortex filament or vorticity surface. The application of the velocity and acceleration potential theory to the determination of flow fields around three dimensional, non-rotating bodies as well as to rotor aerodynamic problems is described. Airfoil sections suitable for rotors are also considered.

79N21073*# ISSUE 12 PAGE 1524 CATEGORY 7 RPT#: NASA-CR-159558 DDA-EDR-9528 CNT#: NAS3-20756 79/04/10 147 PAGES UNCLASSIFIED DOCUMENT

UTTL: Study of an advanced General Aviation Turbine Engine (GATE) TLSP: Final Report

AUTH: A/GILL, J. C.; B/SHORT, F. R.; C/STATON, D. V.; D/ZOLEZZI, B. A.; E/CURRY, C. E.; F/ORELUP, M. J.; G/VAUGHT, J. M.; H/HUMPHREY, J. M.

CORP: Detroit Diesel Allison, Indianapolis, Ind. AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /*GAS TURBINE ENGINES/*GENERAL AVIATION AIRCRAFT/* TECHNOLOGY ASSESSMENT

MINS: / AIRCRAFT INDUSTRY/ AIRCRAFT PERFORMANCE/ COST ANALYSIS/ ENGINE DESIGN/ FUEL CONSUMPTION/ HELICOPTERS / ROTARY WINGS/ TURBOFAN ENGINES/ TURBOPROP ENGINES/ TURBOSHAFTS/ WEIGHT ANALYSIS

ABA: S.E.S.

ABS: The best technology program for a small, economically viable gas turbine engine applicable to the general aviation helicopter and aircraft market for 1985-1990 was studied. Turboshaft and turboprop engines in the 112 to 746 kW (150 to 1000 hp) range and turbofan engines up to 6672 N (1500 lbf) thrust were considered. A good market for new turbine engines was predicted for 1988 providing aircraft are designed to capitalize on the advantages of the turbine engine. Parametric engine families were defined in terms of design and off-design performance, mass, and cost. These were evaluated in aircraft design missions selected to represent important market segments for fixed and rotary-wing applications. Payoff parameters influenced by engine cycle and configuration changes were aircraft gross mass, acquisition cost, total cost of ownership, and cash flow. Significant advantage over a current technology, small gas turbine engines was found especially in cost of ownership and fuel economy for airframes incorporating an air-cooled high-pressure ratio engine. A power class of 373 kW (500 hp) was recommended as the next frontier for technology advance where large improvements in fuel economy and engine mass appear possible through component research and development.

79N20769*# ISSUE 11 PAGE 1481 CATEGORY 61 RPT#: NASA-CR-159020 CNT#: NAS1-14358 79/03/00 86 PAGES UNCLASSIFIED DOCUMENT

UTTL: Users manual for linear Time-Varying Helicopter Simulation (Program TVHIS)

AUTH: A/BURNS, M. R.

CORP: Analytic Sciences Corp., Reading, Mass. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*AIRCRAFT MODELS/*COMPUTERIZED SIMULATION/* HELICOPTERS/*USER MANUALS (COMPUTER PROGRAMS)

MINS: / ACTUATORS/ AIRBORNE/SPACEBORNE COMPUTERS/ COMMAND AND CONTROL/ LOGIC DESIGN/ ROTORS/ TRAJECTORY OPTIMIZATION

ABA: J.M.S.

ABS: A linear time-varying helicopter simulation program (TVHIS) is described. The program is designed as a realistic yet efficient helicopter simulation. It is based on a linear time-varying helicopter model which includes rotor, actuator, and sensor models, as well as a simulation of flight computer logic. The TVHIS can generate a mean trajectory simulation along a nominal trajectory, or propagate covariance of helicopter states, including rigid-body, turbulence, control command, controller states, and rigid-body state estimates.

79N20103*# ISSUE 11 PAGE 1390 CATEGORY 5 RPT#: NASA-CR-152261 CNT#: NAS2-7613 78/06/00 38 PAGES UNCLASSIFIED DOCUMENT

UTTL: The role of rotor impedance in the vibration analysis of rotorcraft, part 4 TLSP: Final Report

AUTH: A/HOHENEMSER, K. H.

CORP: Washington Univ., St. Louis, Mo.; Army Aviation Research and Development Command, Moffett Field, Calif. CSS: (School of Engineering and Applied Science.) AVAIL.NTIS SAP: HC A03/MF A01 Prepared for Army Aviation Res. and Develop. Command, Moffett Field, Calif.

MAJS: /*ROTOR AERODYNAMICS/*ROTORCRAFT AIRCRAFT/*VIBRATION TESTS

MINS: / AERODYNAMIC FORCES/ AEROELASTICITY/ DYNAMIC RESPONSE / EXCITATION/ FINITE ELEMENT METHOD/ IMPEDANCE/ PITCHING MOMENTS/ ROLLING MOMENTS/ ROTOR BLADES (TURBOMACHINERY)

ABA: S.E.S.

ABS: A method for a strongly idealized case of vertical excitation and for rolling and pitching moment excitation of a four bladed hingeless rotor on an

[illegible] flexible mount is developed. The aeroelastic rotor impedances are computed directly with a finite blade element method that includes aerodynamics. The rotor impedance matrix for three or more blades is determined from the root moment impedance for a single blade by a simple multiblade transformation rule. Force and moment amplitudes transferred from the rotor to support are found to be critically dependent on the support dynamics.

79N20006*# ISSUE 11 PAGE 1375 CATEGORY 8
78/00/00 15 PAGES UNCLASSIFIED DOCUMENT
UTTL: Observations on the dynamic stall characteristics of advanced helicopter rotor airfoils
AUTH: A/DADONE, L.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A14/MF A01
In NASA. Langley Res. Center Advanced Technol. Airfoil Res., Vol. 1, Pt. 2 p 701-715 (SEE N79-19989 11-01)
MAJS: /*AERODYNAMIC STALLING/*AIRFOILS/*HELICOPTER PERFORMANCE/*ROTARY WINGS
MINS: / DYNAMIC CHARACTERISTICS/ TRANSONIC FLOW/ UNSTEADY STATE/ WING OSCILLATIONS
ABA: Author
ABS: A significant amount of research was devoted to understanding the mechanism of dynamic stall delay as applicable to the flow environment of a helicopter rotor in forward flight. One aspect of such research deals with the unsteady characteristics of two-dimensional airfoil sections over a Mach number range from 0.3 to 9.6, since such characteristics can be meaningfully related to rotor performance and loads. This paper summarizes the results of several oscillatory tests carried out on conventional, transonic and BLC-equipped airfoils.

79N17811*# ISSUE 9 PAGE 1071 CATEGORY 2 RPT#: NASA-CR-3083 CNT#: NAS2-7007 79/01/00 242 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotary-wing aerodynamics. Volume 2: Performance prediction of helicopters TLSP: Final Report
AUTH: A/KEYS, C. N.; B/STEPHNIEWSKI, W. Z. PAT: B/ed.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A11/MF A01
MAJS: /*AERODYNAMIC CHARACTERISTICS/*HELICOPTER PERFORMANCE /*PERFORMANCE PREDICTION/*ROTARY WINGS
MINS: / AERODYNAMIC CONFIGURATIONS/ HELICOPTER DESIGN/ TANDEM ROTOR HELICOPTERS/ WINGED VEHICLES
ABA: L.S.
ABS: Application of theories, as well as, special methods of procedures applicable to performance prediction are illustrated first, on an example of the conventional helicopter and then, winged and tandem configurations. Performance prediction of conventional helicopters in hover and vertical ascent are investigated. Various approaches to performance prediction in forward translation are presented. Performance problems are discussed only this time, a wing is added to the baseline configuration, and both aircraft are compared with respect to their performance. This comparison is extended to a tandem. Appendices on methods for estimating performance guarantees and growth of aircraft concludes this volume.

79N17421*# ISSUE 8 PAGE 1015 CATEGORY 47
78/03/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter icing research
AUTH: A/ADAMS, R. I.
CORP: Army Research and Technology Labs., Fort Eustis, Va. AVAIL.NTIS SAP: HC A12/MF A01
In Tenn. Univ. Space Inst. Proc. of the 2nd Ann. Workshop on Meteorol. and Environ. Inputs to Aviation Systems p 139-152 (SEE N79-17413 08-47)
MAJS: /*HELICOPTERS/*ICE FORMATION/*PROTECTIVE COATINGS/* RESEARCH
MINS: / FLIGHT TESTS/ PROTECTION/ TABLES (DATA)/ UH-1 HELICOPTER/ V/STOL AIRCRAFT
ABA: G.Y.
ABS: A representative of the U.S. Army Research and Technology Laboratories was called upon to brief the workshop on results of flight test experiments with ice-phobic coatings applied to helicopter rotor blades. An overview of the Applied Technology Laboratory helicopter icing R and D program is presented.

79N15619*# ISSUE 6 PAGE 772 CATEGORY 54
78/11/00 4 PAGES UNCLASSIFIED DOCUMENT
UTTL: Lightweight helmet-mounted eye movement measurement system
AUTH: A/BARNES, J. A.
CORP: Human Engineering Labs., Aberdeen Proving Ground, Md. AVAIL.NTIS SAP: HC A99/MF A01
In NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control p 437-440 (SEE N79-15588 05-54)
MAJS: /*EYE MOVEMENTS/*FLIGHT CREWS/*HELMETS/*MEASURING INSTRUMENTS
MINS: / HELICOPTERS/ HUMAN FACTORS ENGINEERING/ STRUCTURAL DESIGN/ TELEVISION CAMERAS
ABA: L.S.
ABS: The helmet-mounted eye movement measuring system, weighs 1,530 grams; the weight of the present aviators' helmet in standard form with the visor is

1,545 grams. The optical head is standard NAC Eye-Mark. This optical head was mounted on a magnesium yoke which in turn was attached to a slide cam mounted on the flight helmet. The slide cam allows one to adjust the eye-to-optics system distance quite easily and to secure it so that the system will remain in calibration. The design of the yoke and slide cam is such that the subject can, in an emergency, move the optical head forward and upward to the stowed and locked position atop the helmet. This feature was necessary for flight safety. The television camera that is used in the system is a solid state General Electric TN-2000 with a charged induced device imager used as the vidicon.

79N15615*# ISSUE 6 PAGE 771 CATEGORY 54
78/11/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: A head-up display for mid-air drone recovery
AUTH: A/AUGUSTINE, J. L.; B/HEFT, E. L.; C/BOWEN, T. E.; D/NEWMAN, R. L.
CORP: Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.; Tactical Drone Squadron (11th), Davis-Monthan AFB Ariz.; Crew Systems Consultants, Yellow Springs, O[illegible] AVAIL.NTIS SAP: HC A99/MF A01
In NASA. Ames Res. Center The 14th Ann. Conf. on Manual Control p 381-394 (SEE N79-15588 06-54)
Prepared in cooperation with Tactical Drone Squadron (11th), Davis-Monthan AFB, Ariz. and Crew Systems Consultants, Yellow Springs, Ohio
MAJS: /*DRONE AIRCRAFT/*HEAD-UP DISPLAYS/*RETRIEVAL
MINS: / AIRCRAFT STABILITY/ DISPLAY DEVICES/ HELICOPTERS/ PROBLEM SOLVING/ ROLL
ABA: G.Y.
ABS: During mid-air retrieval of parachute packages, the absence of a natural horizon creates serious difficulties for the pilot of the recovery helicopter. A head-up display (HUD) was tested in an attempt to solve this problem. Both a roll-stabilized HUD and a no-roll (pitch only) HUD were tested. The results show that fewer missed passes occurred with the roll-stabilized HUD when the horizon was obscured. The pilots also reported that the workload was greatly reduced. Roll-stabilization was required to prevent vertigo when flying in the absence of a natural horizon. Any HUD intended for mid-air retrieval should display pitch, roll, sideslip, airspeed, and vertical velocity.

79N15025*# ISSUE 6 PAGE 689 CATEGORY 5 RPT#:
NASA-CR-152948 CNT#: NAS1-14010 78/12/00 203
PAGES UNCLASSIFIED DOCUMENT

UTTL: Flight test design for CH-47 parameter identification
AUTH: A/HALL, W. E., JR.; B/VINCENT, J.
CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS SAP: HC A10/MF A01
MAJS: /*AIRCRAFT MANEUVERS/*CH-47 HELICOPTER/*DYNAMIC CHARACTERISTICS/*FLIGHT TESTS/*MATHEMATICAL MODELS
MINS: / AIRCRAFT LANDING/ APPROACH/ COMPUTERIZED SIMULATION/ DATA ACQUISITION/ FLIGHT TESTS/ TERMINAL FACILITIES
ABA: G.Y.
ABS: The VTOL Approach and Landing Technology (VALT) program is a significant experimental research program aimed at establishing a data base for rotorcraft operation in a terminal area environment. Work was undertaken to determine helicopter math models suitable for analyzing maneuvers along a VTOL trajectory and to apply these math models to determine the flight test procedures of greatest effectiveness in establishing helicopter dynamic characteristics in this mode of operation. As the principal result of this investigation, a flight test specification is presented for the CH-47 VALT aircraft operating along the specified VTOL trajectory of the VALT program.

79N14079*# ISSUE 5 PAGE 557 CATEGORY 5 RPT#:
NASA-CR-158985 CNT#: NAS1-14552 78/04/00 39 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Application of higher harmonic blade feathering for helicopter vibration reduction
AUTH: A/POWERS, R. W.
CORP: Hughes Helicopters, Culver City, Calif. AVAIL.NTIS SAP: HC A03/MF A01
MAJS: /*ADAPTIVE CONTROL/*FEATHERING/*HELICOPTERS/*ROTOR BLADES/*VIBRATION DAMPING
MINS: / HARMONIC OSCILLATION/ PREDICTION ANALYSIS TECHNIQUES / TRANSFER FUNCTIONS/ VIBRATORY LOADS/ WIND TUNNEL TESTS
ABA: G.G.
ABS: Higher harmonic blade feathering for helicopter vibration reduction is considered. Recent wind tunnel tests confirmed the effectiveness of higher harmonic control in reducing articulated rotor vibratory hub loads. Several predictive analyses developed in support of the NASA program were shown to be capable of calculating single harmonic control inputs required to minimize a single 4P hub response. In addition, a multiple-input, multiple-output harmonic control predictive analysis was developed. All techniques developed thus far obtain a solution by extracting empirical transfer functions from sampled data. Algorithm data sampling and processing requirements

are minimal to encourage adaptive control system application of such techniques in a flight environment.

79N13819*# ISSUE 4 PAGE 520 CATEGORY 71 RPT#: NASA-CR-158973 CNT#: NAS1-14970 78/12/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: A laboratory study of the subjective response to helicopter blade-slap noise

AUTH: A/SHEPHERD, K. P.

CORP: Bionetics Corp., Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*EFFECTIVE PERCEIVED NOISE LEVELS/*HELICOPTER PROPELLER DRIVE/*PROPELLER BLADES

MINS: / AIRCRAFT NOISE/ AUDITORY STIMULI/ HUMAN TOLERANCES/ NOISE INTENSITY

ABA: G.G.

ABS: The test stimuli recorded during a recent field study consisted of 16 sounds, each presented at 4 peak noise levels. Two helicopters and a fixed-wing aircraft were used. The impulsive characteristics of one helicopter were varied by operating at different rotor speeds, whereas the other helicopter, the noise of which was dominated by the tail rotor, displayed little variation in blade-slap noise. Thirty-two subjects made noisiness judgments on a continuous, 11 point, numerical scale. Preliminary results indicate that proposed impulsiveness corrections provide no significant improvement in the noisiness predictive ability of Effective Perceived Noise Levels (EPNL). For equal EPNL, the two categories of helicopter stimuli, one of which was far more impulsive than the other, showed no difference in judged noisiness. Examination of the physical characteristics of the sounds presented in the laboratory highlighted the difficulty of reproducing acoustical signals with high-crest factors.

79N13036*# ISSUE 4 PAGE 414 CATEGORY 6 RPT#: NASA-CR-3060 CNT#: NAS1-1498 78/12/00 122 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter mission optimization study --- portable computer technology for flight optimization TLSP: Final Report

AUTH: A/OLSON, J. R.

CORP: United Technologies Corp., Stratford, Conn. CSS: (Sikorsky Div.) AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*COMPUTER TECHNIQUES/*FLIGHT OPTIMIZATION/* HELICOPTERS/*PILOT PERFORMANCE

MINS: / AIRCRAFT INSTRUMENTS/ FEASIBILITY ANALYSIS/ FUEL CONSUMPTION/ NOISE REDUCTION/ PORTABLE EQUIPMENT

ABA: G.G.

ABS: The feasibility of using low-cost, portable computer technology to help a helicopter pilot optimize flight parameters to minimize fuel consumption and takeoff and landing noise was demonstrated. Eight separate computer programs were developed for use in the helicopter cockpit using a hand-held computer. The programs provide the helicopter pilot with the ability to calculate power required, minimum fuel consumption for both range and endurance, maximum speed and a minimum noise profile for both takeoff and landing. Each program is defined by a maximum of two magnetic cards. The helicopter pilot is required to key in the proper input parameter such as gross weight, outside air temperature or pressure altitude.

79N10862*# ISSUE 1 PAGE 114 CATEGORY 71 78/08/00 58 PAGES UNCLASSIFIED DOCUMENT

UTTL: The status of rotor noise technology: One man's opinion

AUTH: A/WHITE, R. P., JR.

CORP: Systems Research Labs., Inc., Dayton, Ohio. CSS: (RASA Div.) AVAIL.NTIS SAP: HC A19/MF A01

In NASA. Langley Res. Center Helicopter Acoustics Pt. 2 p 723-780 (SEE N79-10843 01-71)

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*ROTARY WINGS/*ROTOR AERODYNAMICS/*TECHNOLOGY ASSESSMENT

MINS: / AEROACOUSTICS/ NOISE REDUCTION/ TIP SPEED/ VIBRATION

ABA: J.M.S.

ABS: The problem of establishing the state of the technology is approached by first identifying the various characteristics of rotor noise and then assessing the state of technology in understanding and predicting the most important of these rotor noise characteristics in a real-world environment.

79N10861*# ISSUE 1 PAGE 114 CATEGORY 71 78/08/00 28 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter internal noise reduction research and development application to the SA 360 and SA 365 Dauphin

AUTH: A/MARZE, H. J.; B/DAMBRA, F.

CORP: Societe Nationale Industrielle Aerospatiale, Paris (France). AVAIL.NTIS SAP: HC A19/MF A01

In NASA. Langley Res. Center Helicopter Acoustics. Pt. 2 p 695-722 (SEE N79-10843 01-71)

MAJS: /*AIRCRAFT COMPARTMENTS/*AIRCRAFT NOISE/*HELICOPTERS/* NOISE REDUCTION

MINS: / ENERGY ABSORPTION/ GEARS/ TRANSMISSIONS (MACHINE ELEMENTS)/ VIBRATION ISOLATORS

ABA: J.M.S.

ABS: Noise sources inside helicopter cabins are considered with emphasis on the mechanisms of vibration

generation inside the main gear box and mechanisms of transmission between source and cabin. The dynamic benavior of the main gear box comoonents is examined in relation to the transfer of vibration energy to the structure. It is indicated that although improvements can be made in noise reduction at the source, a soundproofing treatment isolating the passenger from the noise source is necessary. Soundproofing treatments installed and optimized include: (1) an acoustic screen using the weight effect to isolate the passenger from the noise source; (2) a damping treatment to limit the conversion of the vibratory energy into acoustic energy; and (3) an absorbing treatment achieved either through HELMHOLTZ resonators or through a glass wool blanket to limit the propagation of acoustic waves and the wave reflection effects in the cabin. The application of treatments at the source and the optimization of the sound barriers improved the noise level by about 30 db.

79N10860*# ISSUE 1 PAGE 114 CATEGORY 71
78/08/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: The influence of the noise environment on crew communications
AUTH: A/LEVERTON, J. W.
CORP: Westland Helicopters Ltd., Yeovil (England).
AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics. Pt. 2 p 679-693 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT COMPARTMENTS/*AIRCRAFT NOISE/*ENVIRONMENTAL CONTROL/*HELICOPTERS/*VOICE COMMUNICATION
MINS: / ACOUSTIC ATTENUATION/ HELMETS/ MICROPHONES/ NOISE REDUCTION/ SIGNAL TO NOISE RATIOS
ABA: J.M.S.
ABS: The noise environment and how it affects crew communications in helicopters is considered. The signal to noise (S/N) ratio at the microphone and the effect of the attenuation provided by the helmet is discussed. This shows that the most important aspect is the S/N ratio at the microphone, particularly when helmets with improved attenuation characteristics are considered. Evidence is presented which shows that in high noise environments, the system S/N ratio is well below that required and hence there is an urgent need to reduce the cabin noise levels and improve the microphone rejection properties. Emphasis is placed on environmental/acoustic considerations.

79N10859*# ISSUE 1 PAGE 114 CATEGORY 71 CNT#: DAAJ02-74-C-0039 78/08/00 21 PAGES UNCLASSIFIED DOCUMENT

UTTL: An analytical method for designing low noise helicopter transmissions
AUTH: A/BOSSLER, R. B., JR.; B/BOWES, M. A.; C/ROYAL, A. C. PAA: C/(Army Res. and Technol. Labs.)
CORP: Kaman Aerospace Corp., Bloomfield, Conn. AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics. Pt. 2 p 657-677 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTER DESIGN/*NOISE REDUCTION/* TRANSMISSIONS (MACHINE ELEMENTS)
MINS: / GEARS/ PREDICTION ANALYSIS TECHNIQUES
ABA: J.M.S.
ABS: The development and experimental valication of a method for analytically modeling the noise mechanism in the helicopter geared power transmission systems is described. This method can be used within the design process to predict interior noise levels and to investigate the noise reducing potential of alternative transmission design details. Examples are discussed.

79N10858*# ISSUE 1 PAGE 114 CATEGORY 71
78/08/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter internal noise control: Three case histories
AUTH: A/EDWARDS, B. D.; B/COX, C. R.
CORP: Textron Bell Helicopter, Fort Worth, Tex.
AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics. Pt. 2 p 639-656 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT COMPARTMENTS/*AIRCRAFT NOISE/*HELICOPTER DESIGN/*NOISE REDUCTION
MINS: / ACOUSTICS/ ELASTOMERS/ ENGINE NOISE/ SOUND TRANSMISSION/ WEIGHT (MASS)
ABA: J.M.S.
ABS: Case histories are described in which measurable improvements in the cabin noise environments of the Bell 214B, 206B, and 222 were realized. These case histories trace the noise control efforts followed in each vehicle. Among the design approaches considered, the addition of a fluid pulsation damper in a hydraulic system and the installation of elastomeric engine mounts are highlighted. It is concluded that substantial weight savings result when the major interior noise sources are controlled by design, both in altering the noise producing mechanism and interrupting the sound transmission paths.

79N10857*# ISSUE 1 PAGE 114 CATEGORY 71
78/08/00 44 PAGES UNCLASSIFIED DOCUMENT
UTTL: A practical approach to helicopter internal noise prediction
AUTH: A/LEVINE, L. S.; B/DEFELICE, J. J.
CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS
SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 595-638 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT COMPARTMENTS/*AIRCRAFT NOISE/*HELICOPTERS/* PREDICTION ANALYSIS TECHNIQUES
MINS: / AUDITORY PERCEPTION/ EFFECTIVE PERCEIVED NOISE LEVELS/ ENGINE NOISE/ NOISE INTENSITY/ NOISE REDUCTION / SPEECH
ABA: J.M.S.
ABS: A practical and well correlated procedure for predicting helicopter internal noise is presented. It accounts for the propagation of noise along multiple paths on an octave by octave basis. The method is sufficiently general to be applicable to conventional helicopters as well as other aircraft types, when the appropriate structural geometry, noise source strengths, and material acoustic properties are defined. A guide is provided for the prediction of various helicopter noise sources over a wide range of horsepower for use when measured data are not available. The method is applied to the prediction of the interior levels of the Civil Helicopter Research Aircraft (CHRA), both with and without soundproofing installed. Results include good correlation with measured levels and prediction of the speech interference level within 1.5 db at all conditions. A sample problem is also shown illustrating the use of the procedure. This example calculates the engine casing noise observed in the passenger cabin of the CHRA.

79N10856*# ISSUE 1 PAGE 113 CATEGORY 71
78/08/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter cabin noise: Methods of source and path identification and characterization
AUTH: A/MURRAY, B. S.; B/WILBY, J. F.
CORP: Bolt, Beranek, and Newman, Inc., Cambridge, Mass. AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 583-594 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT COMPARTMENTS/*AIRCRAFT NOISE/*HELICOPTERS/* NOISE GENERATORS/*SOUND PROPAGATION
MINS: / ENGINE NOISE/ HELICOPTER PERFORMANCE/ NOISE REDUCTION/ TURBULENT BOUNDARY LAYER/ WEIGHT (MASS)
ABA: J.M.S.
ABS: Internal noise sources in a helicopter are considered. These include propulsion machinery, comprising engine and transmission, and turbulent boundary layer effects. It is shown that by using relatively simple concepts together with careful experimental work it is possible to generate reliable data on which to base the design of high performance noise control treatments.

79N10855*# ISSUE 1 PAGE 113 CATEGORY 71 CNT#: DOT-FA76WA-3791 78/08/00 20 PAGES UNCLASSIFIED DOCUMENT
UTTL: The cost of applying current helicopter external noise reduction methods while maintaining realistic vehicle performance
AUTH: A/BOWES, M. A.
CORP: Kaman Aerospace Corp., Bloomfield, Conn. AVAIL.NTIS
SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 563-582 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTER DESIGN/*HELICOPTER PERFORMANCE/*NOISE REDUCTION
MINS: / COST EFFECTIVENESS/ DUCTS/ EXHAUST SYSTEMS/ ROTARY WINGS/ TURBINE ENGINES
ABA: J.M.S.
ABS: Analytical methods were developed and/or adopted for calculating helicopter component noise, and these methods were incorporated into a unified total vehicle noise calculation model. Analytical methods were also developed for calculating the effects of noise reduction methodology on helicopter design, performance, and cost. These methods were used to calculate changes in noise, design, performance, and cost due to the incorporation of engine and main rotor noise reduction methods. All noise reduction techniques were evaluated in the context of an established mission performance criterion which included consideration of hovering ceiling, forward flight range/speed/payload, and rotor stall margin. The results indicate that small, but meaningful, reductions in helicopter noise can be obtained by treating the turbine engine exhaust duct. Furthermore, these reductions do not result in excessive life cycle cost penalties. Currently available main rotor noise reduction methodology, however, is shown to be inadequate and excessively costly.

79N10854*# ISSUE 1 PAGE 113 CATEGORY 71 CNT#: NAS1-15226 78/08/00 11 PAGES UNCLASSIFIED DOCUMENT
UTTL: Design of helicopter rotors to noise constraints
AUTH: A/SCHAEFFER, E. G.; B/STERNFELD, H., JR.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
SAP: HC A19/MF A01

In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 551-561 (SEE N79-10843 01-71)

MAJS: /*AIRCRAFT NOISE/*HELICOPTER DESIGN/*NOISE REDUCTION/* ROTARY WINGS

MINS: / EFFECTIVE PERCEIVED NOISE LEVELS/ NOISE SPECTRA/ SPECTRAL SENSITIVITY/ THRUST/ TIP SPEED

ABA: J.M.S.

ABS: Results of the initial phase of a research project to study the design constraints on helicopter noise are presented. These include the calculation of nonimpulsive rotor harmonic and broadband hover noise spectra, over a wide range of rotor design variables and the sensitivity of perceived noise level (PNL) to changes in rotor design parameters. The prediction methodology used correlated well with measured whirl tower data. Application of the predictions to variations in rotor design showed tip speed and thrust as having the most effect on changing PNL.

79N10853*# ISSUE 1 PAGE 113 CATEGORY 71
78/08/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: An active noise reduction system for aircrew helmets

AUTH: A/WHEELER, P. D.; B/RAWLINSON, D.; C/PELC, S. F.; D/DOREY, T. P.

CORP: Southampton Univ. (England). CSS: (Wolfson Unit for Noise and Vibration Control, ISVR.) AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 545-550 (SEE N79-10843 01-71)

MAJS: /*ACOUSTIC ATTENUATION/*AIRCRAFT NOISE/*BIOACOUSTICS/* HELMETS/*NOISE REDUCTION

MINS: / FLIGHT SIMULATION/ HELICOPTERS/ ROTARY WINGS

ABA: J.M.S.

ABS: An active noise reduction system was developed for use in aircrew flying helmets in which the acoustic noise field inside the ear defender is detected using a miniature microphone and an antiphase signal is fed back to a communications telephone within the ear defender. Performance of the active noise reduction system in a laboratory trial simulating flight conditions is shown to be satisfactory.

79N10852*# ISSUE 1 PAGE 113 CATEGORY 71
78/08/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: A static acoustic signature system for the analysis of dynamic flight information

AUTH: A/RAMER, D. J.

CORP: Army Armament Research and Development Command, Aberdeen Proving Ground, Md. AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 535-544 (SEE N79-10843 01-71)

MAJS: /*AIRCRAFT NOISE/*MILITARY HELICOPTERS/*NOISE MEASUREMENT/*SIGNATURE ANALYSIS

MINS: / ANALYSIS (MATHEMATICS)/ FLIGHT CHARACTERISTICS/ MICROPHONES/ POSITION (LOCATION)/ RANGEFINDING/ SOUND PROPAGATION

ABA: J.M.S.

ABS: The Army family of helicopters was analyzed to measure the polar octave band acoustic signature in various modes of flight. A static array of calibrated microphones was used to simultaneously acquire the signature and differential times required to mathematically position the aircraft in space. The signature was then reconstructed, mathematically normalized to a fixed radius around the aircraft.

79N10850*# ISSUE 1 PAGE 113 CATEGORY 71
78/08/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: The effective acoustic environment of helicopter crewmen

AUTH: A/CAMP, R. T., JR.; B/MOZO, B. T.

CORP: Army Aeromedical Research Lab., Fort Rucker, Ala. CSS: (Bioacoustics Div.) AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 513-517 (SEE N79-10843 01-71)

MAJS: /*AIRCRAFT COMPARTMENTS/*AIRCRAFT NOISE/*MILITARY HELICOPTERS/*NOISE MEASUREMENT

MINS: / AUDITORY FATIGUE/ AUDITORY PERCEPTION/ BACKGROUND NOISE/ EAR/ EFFECTIVE PERCEIVED NOISE LEVELS/ HUMAN TOLERANCES/ VOICE COMMUNICATION

ABA: J.M.S.

ABS: Methods of measuring the composite acoustic environment of helicopters in order to quantify the effective acoustic environment of the crewmen and to assess the real acoustic hazards of the personnel are examined. It is indicated that the attenuation characteristics of the helmets and hearing protectors and the variables of the physiology of the human ear be accounted for in determining the effective acoustic environment of Army helicopter crewmen as well as the acoustic hazards of voice communications systems noise.

79N10849*# ISSUE 1 PAGE 113 CATEGORY 71 CNT#: DAAJ01-74-C-1054 78/08/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: A method for determining internal noise criteria based on practical speech communication applied to helicopters

AUTH: A/STERNFELD, H., JR.; B/DOYLE, L. B.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A19/MF A01

In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 493-511 (SEE N79-10843 01-71)

MAJS: /*AIRCRAFT COMPARTMENTS/*AIRCRAFT NOISE/*AUDITORY PERCEPTION/*HELICOPTERS/*SPEECH/*VOICE COMMUNICATION
MINS: / AUDITORY FATIGUE/ PSYCHOACOUSTICS/ STANDARDS
ABA: J.M.S.
ABS: The relationship between the internal noise environment of helicopters and the ability of personnel to understand commands and instructions was studied. A test program was conducted to relate speech intelligibility to a standard measurement called Articulation Index. An acoustical simulator was used to provide noise environments typical of Army helicopters. Speech material (command sentences and phonetically balanced word lists) were presented at several voice levels in each helicopter environment. Recommended helicopter internal noise criteria, based on speech communication, were derived and the effectiveness of hearing protection devices were evaluated.

79N10846*# ISSUE 1 PAGE 112 CATEGORY 71
78/08/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: Annoyance of helicopter impulsive noise
AUTH: A/DAMBRA, F.; B/DAMONGEOT, A.
CORP: Societe Nationale Industrielle Aerospatiale, Paris (France). AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 439-462 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE TOLERANCE/* PSYCHOACOUSTICS
MINS: / CORRECTION/ HUMAN TOLERANCES/ REGRESSION ANALYSIS/ STANDARDS/ STATISTICAL CORRELATION
ABA: J.M.S.
ABS: Psychoacoustic studies of helicopter impulsive noise were conducted in order to qualify additional annoyance due to this feature and to develop physical impulsiveness descriptors to develop impulsivity correction methods. The currently proposed descriptors and methods of impulsiveness correction are compared using a multilinear regression analysis technique. It is shown that the presently recommended descriptor and correction method provides the best correlation with the subjective evaluations of real helicopter impulsive noises. The equipment necessary for data processing in order to apply the correction method is discussed.

79N10845*# ISSUE 1 PAGE 112 CATEGORY 71
78/08/00 19 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rating helicopter noise
AUTH: A/LEVERTON, J. W.; B/SOUTHWOOD, B. J.; C/PIKE, A. C.
CORP: Westland Helicopters Ltd., Yeovil (England). AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 419-438 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTER TAIL ROTORS
MINS: / CORRECTION/ EFFECTIVE PERCEIVED NOISE LEVELS/ NOISE MEASUREMENT/ STATISTICAL CORRELATION
ABA: J.M.S.
ABS: The effectiveness of the EPNL procedure in quantifying helicopter blade slap and tail rotor noise heard on approach some distance from the flyover position is addressed. Alternative methods of rating helicopter noise are reviewed including correction procedures to the EPNL concept which account for blade slap and tail rotor noise. The impact of the use of such corrections is examined.

79N10844*# ISSUE 1 PAGE 112 CATEGORY 71
78/08/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Subjective evaluation of helicopter blade slap noise
AUTH: A/GALLOWAY, W. J.
CORP: Bolt, Beranek, and Newman, Inc., Cambridge, Mass. AVAIL.NTIS SAP: HC A19/MF A01
In NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 p 403-418 (SEE N79-10843 01-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*ROTARY WINGS
MINS: / DIGITAL TECHNIQUES/ EFFECTIVE PERCEIVED NOISE LEVELS / NOISE SPECTRA/ NOISE TOLERANCE/ SIGNATURE ANALYSIS/ SPECTRAL SIGNATURES
ABA: J.M.S.
ABS: Several methods for adjusting EPNL to account for its underestimate of judged annoyance are applied to eight helicopter flyover noise signatures having various degrees of blade slap. A proposal for an impulsive noise correlation procedure based on a digital analysis of the flyover signal is investigated. When all data are combined, the proposal is little better than simply adding an arbitrary fixed adjustment of 3 decibels to EPNL.

79N10453*# ISSUE 1 PAGE 60 CATEGORY 39
78/10/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Finite element analysis of helicopter structures
AUTH: A/RICH, M. J.
CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS SAP: HC A10/MF A01
In NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., p 51-61 (SEE N79-10448

01-39)
MAJS: /*COMPUTERIZED SIMULATION/*DYNAMIC STRUCTURAL ANALYSIS /*FINITE ELEMENT METHOD/*HELICOPTERS
MINS: / AIRFRAMES/ COMPONENTS/ COMPOSITE STRUCTURES
ABA: G.G.
ABS: Application of the finite element analysis is now being expanded to three dimensional analysis of mechanical components. Examples are presented for airframe, mechanical components, and composite structure calculations. Data are detailed on the increase of model size, computer usage, and the effect on reducing stress analysis costs. Future applications for use of finite element analysis for helicopter structures are projected.

79N10423*# ISSUE 1 PAGE 57 CATEGORY 37 RPT#: NASA-CR-135372 LYC-77-65 CNT#: NAS3-20045 77/10/00 41 PAGES UNCLASSIFIED DOCUMENT
UTTL: Transmission seal development TLSP: Final Report, 1 Jul. 1976 - 30 Apr. 1977
AUTH: A/BRIEN, M.
CORP: Avco Lycoming Div., Stratford, Conn. AVAIL.NTIS SAP: HC A03/MF A01
Sponsored in part by USAAMRDC
MAJS: /*FLUID TRANSMISSION LINES/*LEAKAGE/*SEALS (STOPPERS)
MINS: / ELASTOMERS/ HELICOPTERS/ LUBRICATION SYSTEMS/ OILS/ RETAINING/ SEALING
ABA: Author
ABS: An experimental evaluation was performed on a high-speed (72.9 m/s, 14,349 ft/min) transmission seal of the synergistic type. During testing of the seal, oil leakage occurred at positive bearing cavity pressures. Modifications were made in an attempt to eliminate the leakage but none were completely successful. Leakage appears to be the result of questionable positioning of the sealing elements resulting in inadequate shaft contact by the oil side sealing element. This condition may be related to the nonsymmetrical shape of the elastomeric retainer and to dimensional changes caused by swelling of the elastomeric retainer from exposure to the sealed fluid. Indications of a speed dependent leakage characteristic were also observed.

79N10061*# ISSUE 1 PAGE 9 CATEGORY 7 RPT#: NASA-CR-135449 MTI-78TR66 CNT#: NAS3-20609 78/11/00 60 PAGES UNCLASSIFIED DOCUMENT
UTTL: Study of T53 engine vibration TLSP: Final Report
AUTH: A/WALTER, T. J.
CORP: Mechanical Technology, Inc., Latham, N. Y. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*DYNAMIC RESPONSE/*GAS TURBINE ENGINES/*T-53 ENGINE/* VIBRATION
MINS: / COMPUTER PROGRAMS/ COMPUTERIZED SIMULATION/ HELICOPTER ENGINES/ PROPULSION SYSTEM PERFORMANCE
ABA: B.B.
ABS: Vibration characteristics for overhauled T53 engines, including rejection rate, principal sources of vibration, and normal procedures taken by the overhaul center to reduce engine vibration are summarized. Analytical and experimental data were compared to determine the engine's dynamic response to unbalance forces with results showing that the engine operates through bending critical speeds. Present rigid rotor balancing techniques are incapable of compensating for the flexible rotor unbalance. A comparison of typical test cell and aircraft vibration levels disclosed significant differences in the engine's dynamic response. A probable spline shift phenomenon was uncovered and investigated. Action items to control costs and reduce vibration levels were identified from analytical and experimental studies.

78N33085*# ISSUE 24 PAGE 3174 CATEGORY 5 RPT#: NASA-CR-151959 R-1393 CNT#: NAS2-7738 76/04/00 68 PAGES UNCLASSIFIED DOCUMENT
UTTL: Theoretical study of multicyclic control of a controllable twist rotor
AUTH: A/LEMNIOS, A. Z.; B/DUNN, F. K.
CORP: Kaman Aerospace Corp., Bloomfield, Conn. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*CONTROL STABILITY/*HELICOPTER DESIGN/*ROTARY WINGS/* STRUCTURAL VIBRATION
MINS: / AEROELASTICITY/ COMPUTER PROGRAMS/ FLAPS (CONTROL SURFACES)/ PITCH (INCLINATION)/ VIBRATION EFFECTS
ABA: Author
ABS: Analytical studies were performed to ascertain the feasibility of reducing helicopter rotor induced 4/rev vibratory forces by means of multicyclic flap control input on a dual control, four bladed rotor system. The dual control consisted of a primary inboard pitch horn blade control and a secondary outboard flap control. Flap control was put in at frequencies greater than the rotor rotational speed.

78N32834*# ISSUE 23 PAGE 3139 CATEGORY 71 CNT#: NSG-1474 78/08/00 13 PAGES UNCLASSIFIED DOCUMENT
UTTL: Bounds on thickness and loading noise of rotating blades and the favorable effect of blade sweep on noise reduction
AUTH: A/FARASSAT, F.; B/NYSTROM, P. A.; C/BROWN, T. J.
PAA: C/(AVRADCOM Res. and Technol. Labs.)
CORP: George Washington Univ., Washington, D.C. CSS: (

Joint Inst. for Advancement of Flight Sciences.)
AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 373-385 (SEE N78-32816 23-71) Sponsored in part by AROD

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE REDUCTION/*ROTARY WINGS/*SWEEP EFFECT/*THICKNESS RATIO/*WING LOADING
MINS: / AEROACOUSTICS/ AIRFOIL PROFILES/ NOISE POLLUTION/ POLLUTION CONTROL
ABA: J.M.S.
ABS: The maxima of amplitudes of thickness and loading noise harmonics are established when the radial distribution of blade chord, thickness ratio, and lift coefficient is specified. It is first shown that only airfoils with thickness distribution and chordwise loading distributions which are symmetric with respect to midchord need be considered for finding the absolute maxima of thickness and loading noise. The resulting chordwise thickness and load distributions for these maximum noise conditions require infinite slope at some points along the chord but otherwise are uniform. It is shown that sweeping the blades reduces the thickness and loading noise, but there is no optimum sweep which generates the lowest noise.

78N32833*# ISSUE 23 PAGE 3138 CATEGORY 71
78/08/00 33 PAGES UNCLASSIFIED DOCUMENT

UTTL: The importance of quadrupole sources in prediction of transonic tip speed propeller noise
AUTH: A/HANSON, D. B.; B/FINK, M. R. PAA: B/(United Technol. Res. Center)
CORP: Hamilton Standard, Windsor Locks, Conn. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 339-371 (SEE N78-32816 23-71) Submitted for publication Presented at the Spring Meeting of the Inst. of Acoustics, Cambridge, England, 7 Apr. 1978
MAJS: /*AIRCRAFT NOISE/*BLADE TIPS/*HELICOPTERS/*PROPELLER BLADES/*QUADRUPOLES/*ROTARY WINGS
MINS: / NOISE POLLUTION/ NOISE REDUCTION/ POLLUTION CONTROL/ PREDICTION ANALYSIS TECHNIQUES/ ROTOR AERODYNAMICS/ TRANSONIC SPEED
ABA: J.M.S.
ABS: A theoretical analysis is presented for the harmonic noise of high speed, open rotors. Far field acoustic radiation equations based on the Ffowcs-Williams/Hawkings theory are derived for a static rotor with thin blades and zero lift. Near the plane of rotation, the dominant sources are the volume displacement and the rho U(2) quadrupole, where u is the disturbance velocity component in the direction blade motion. These sources are compared in both the time domain and the frequency domain using two dimensional airfoil theories valid in the subsonic, transonic, and supersonic speed ranges. For nonlifting parabolic arc blades, the two sources are equally important at speeds between the section critical Mach number and a Mach number of one. However, for moderately subsonic or fully supersonic flow over thin blade sections, the quadrupole term is negligible. It is concluded for thin blades that significant quadrupole noise radiation is strictly a transonic phenomenon and that it can be suppressed with blade sweep. Noise calculations are presented for two rotors, one simulating a helicopter main rotor and the other a model propeller. For the latter, agreement with test data was substantially improved by including the quadrupole source term.

78N32832*# ISSUE 23 PAGE 3138 CATEGORY 71
78/08/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Improved methods for calculating the thickness noise
AUTH: A/NAKAMURA, Y.; B/AZUMA, A.
CORP: Tokyo Univ. (Japan). AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 323-337 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*PREDICTION ANALYSIS TECHNIQUES/*ROTARY WINGS/*THICKNESS
MINS: / ACCURACY/ AEROACOUSTICS/ AIRFOIL PROFILES/ NOISE POLLUTION/ POLLUTION CONTROL/ ROTOR AERODYNAMICS
ABA: J.M.S.
ABS: Advanced methods to compute the rotor thickness noise which is predominant in the case of high speed rotor were developed. These methods were deduced from a previous method by transforming the integral coordinate, commuting the order of integration and differential, and/or performing chordwise integration analytically with some adequate assumption. The necessary computational times and waveforms obtained by the previous and three advanced methods were compared. It was then concluded that the advanced methods could save the computational time compared with the previous method with the same accuracy.

78N32829*# ISSUE 23 PAGE 3138 CATEGORY 71
78/08/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter external noise prediction and correlation with flight test
AUTH: A/GUPTA, B. P.
CORP: Textron Bell Helicopter, Fort Worth, Tex.
AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 263-275 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*PREDICTION ANALYSIS

TECHNIQUES/*ROTARY WINGS
MINS: / AERODYNAMIC LOADS/ FLIGHT TESTS/ NOISE POLLUTION/ NOISE REDUCTION/ PERFORMANCE PREDICTION/ POLLUTION CONTROL
ABA: J.M.S.
ABS: Mathematical analysis procedures for predicting the main and tail rotor rotational and broadband noise are presented. The aerodynamic and acoustical data from Operational Loads Survey (OLS) flight program are used for validating the analysis and noise prediction methodology. For the long method of rotational noise prediction, the spanwise, chordwise, and azimuthwise airloading is used. In the short method, the airloads are assumed to be concentrated at a single spanwise station and for higher harmonics an airloading harmonic exponent of 2.0 is assumed. For the same flight condition, the predictions from long and short methods of rotational noise prediction are compared with the flight test results. The short method correlates as well or better than the long method.

78N32828*# ISSUE 23 PAGE 3138 CATEGORY 71
CNT#: DAAG29-76-C-0027 78/08/00 41 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Wind tunnel investigations of model rotor noise at low tip speeds
AUTH: A/ARAVAMUDAN, K. S.; B/LEE, A.; C/HARRIS, W. L.
CORP: Massachusetts Inst. of Tech., Cambridge. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 221-261 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*LOW SPEED/*ROTARY WINGS /*TIP SPEED/*WIND TUNNEL TESTS
MINS: / AEROACOUSTICS/ AIRCRAFT PERFORMANCE/ NOISE POLLUTION / NOISE REDUCTION/ POLLUTION CONTROL/ TURBULENCE
ABA: J.M.S.
ABS: Experimental and related analytical results on model rotor rotational and broadband noise obtained in the anechoic wind tunnel and rotor facility are summarized. Factors studied include various noise sources, effects of helicopter performance parameters on noise generated by a model main rotor, appropriate scaling laws for the various types of main rotor noise, and the effects of intensity and size scales of injected turbulence on the intensity and spectra of broadband noise.

78N32825*# ISSUE 23 PAGE 3137 CATEGORY 71
78/08/00 31 PAGES UNCLASSIFIED DOCUMENT
UTTL: Potential acoustic benefits of circulation control rotors
AUTH: A/WILLIAMS, R. M.; B/CHEESEMAN, I. C. PAA: B/(Southampton Univ.)
CORP: Naval Ship Research and Development Center, Bethesda, Md. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 149-179 (SEE N78-32816 23-71)
MAJS: /*AEROACOUSTICS/*AIRCRAFT NOISE/*HELICOPTERS/*ROTARY WINGS
MINS: / AIRCRAFT PERFORMANCE/ NOISE POLLUTION/ NOISE REDUCTION/ POLLUTION CONTROL/ PREDICTION ANALYSIS TECHNIQUES/ ROTOR AERODYNAMICS
ABA: J.M.S.
ABS: The fundamental aeroacoustic mechanisms responsible for noise generation on a rotating blade are theoretically examined. Their contribution to the overall rotor sound pressure level is predicted. Results from a theory for airfoil trailing edge noise are presented. Modifications and extensions to other source theories are described where it is necessary to account for unique aspects of circulation control (CC) aerodynamics. The circulation control rotor (CCR), as embodied on an X-wing vertical takeoff and landing (VTOL) aircraft, is used as an example for computational purposes, although many of the theoretical results presented are generally applicable to other CC applications (such as low speed rotors, propellers, compressors, and fixed wing aircraft). Using the analytical models, it is shown that the utilization CC aerodynamics theoretically makes possible unprecedented advances in rotor noise reduction. For the X-wing VTOL these reductions appear to be feasible without incurring significant attendant performance and weight penalties.

78N32824*# ISSUE 23 PAGE 3137 CATEGORY 71
78/08/00 21 PAGES UNCLASSIFIED DOCUMENT
UTTL: Theory on acoustic sources
AUTH: A/WRIGHT, S. E.
CORP: Stanford Univ., Calif. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 127-147 (SEE N78-32816 23-71) Sponsored by ONERA
MAJS: /*AEROACOUSTICS/*AIRCRAFT NOISE/*HELICOPTERS/*NOISE PROPAGATION/*ROTARY WINGS
MINS: / NOISE SPECTRA/ PREDICTION ANALYSIS TECHNIQUES/ RADIATION SPECTRA
ABA: J.M.S.
ABS: A theory is described for the radiation emission emission from acoustic multipole sources. The sources

can be stationary or moving at speeds including supersonic and experience stationary or moving disturbances. The effect of finite source disturbutions and disturbances is investigated as well as the manner in which they interact. Distinction is made between source distributions that responsed as a function of time and those that respond as a function of space.

78N32823*# ISSUE 23 PAGE 3137 CATEGORY 71
78/08/00 18 PAGES UNCLASSIFIED DOCUMENT
UTTL: Noise due to rotor-turbulence interaction
AUTH: A/AMIET, R. K.
CORP: United Technologies Research Center, East Hartford, Conn. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 109-126 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE GENERATORS/*NOISE POLLUTION/*ROTARY WINGS/*TURBULENCE
MINS: / HOVERING/ NOISE REDUCTION/ NOISE SPECTRA/ POLLUTION CONTROL/ PREDICTION ANALYSIS TECHNIQUES/ PROPELLER BLADES
ABA: J.M.S.
ABS: A procedure for calculating the noise due to turbulent inflow to a propeller or helicopter rotor in hover is summarized. The method is based on a calculation of noise produced by an airfoil moving in rectilinear motion through turbulence. At high frequency the predicted spectrum is broadband, while at low frequency the spectrum is peaked around multiples of blade passage frequency. The results of a parametric study of the variation of the noise with rotor tip speed, blade number, chord, turbulence scale, and directivity angle are given. A comparison of the theory with preliminary experimental measurements shows good agreement.

78N32822*# ISSUE 23 PAGE 3137 CATEGORY 71
78/08/00 20 PAGES UNCLASSIFIED DOCUMENT
UTTL: Theoretical models of helicopter rotor noise
AUTH: A/HAWKINGS, D. L.
CORP: Westland Helicopters Ltd., Hayes (England). AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 89-108 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE POLLUTION/*POLLUTION CONTROL/*PREDICTION ANALYSIS TECHNIQUES/*ROTARY WINGS
MINS: / HIGH SPEED/ LOW SPEED/ NOISE INTENSITY/ NOISE REDUCTION
ABA: J.M.S.
ABS: For low speed rotors, it is shown that unsteady load models are only partially successful in predicting experimental levels. A theoretical model is presented which leads to the concept of unsteady thickness noise. This gives better agreement with test results. For high speed rotors, it is argued that present models are incomplete and that other mechanisms are at work. Some possibilities are briefly discussed.

78N32821*# ISSUE 23 PAGE 3137 CATEGORY 71
78/08/00 27 PAGES UNCLASSIFIED DOCUMENT
UTTL: Prediction and reduction of rotor broadband noise
AUTH: A/HAYDEN, R. E.; B/ARAVAMUDAN, K. S.
CORP: Bolt, Beranek, and Newman, Inc., Cambridge, Mass. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 61-87 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE REDUCTION/*PREDICTION ANALYSIS TECHNIQUES/*ROTARY WINGS
MINS: / HELICOPTER DESIGN/ NOISE GENERATORS/ NOISE POLLUTION / POLLUTION CONTROL/ ROTOR AERODYNAMICS
ABA: J.M.S.
ABS: Prediction techniques which can be or have been applied to subsonic rotors, and methods for designing helicopter rotors for reduced broadband noise generation are summarized. It is shown how detailed physical models of the noise source can be used to identify approaches to noise control.

78N32820*# ISSUE 23 PAGE 3137 CATEGORY 71
78/08/00 15 PAGES UNCLASSIFIED DOCUMENT
UTTL: The impact of urban operations on helicopter noise requirements
AUTH: A/SPECTOR, S. R.
CORP: Hughes Helicopters, Culver City, Calif. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 45-59 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*HELIPORTS/*NOISE POLLUTION/*POLLUTION CONTROL/*URBAN TRANSPORTATION
MINS: / GOVERNMENT/INDUSTRY RELATIONS/ NOISE REDUCTION/ SAFETY FACTORS/ STANDARDS/ URBAN DEVELOPMENT
ABA: J.M.S.
ABS: The interrelationship of urban helicopter operations, helicopter noise, and the establishment of urban public-use heliports is discussed. Public resistance to urban helicopter operations due to concern for safety and noise is shown to negatively impact the establishment of public-use heliports in urban centers. It is indicated that increased government and industry effort to reduce helicopter noise is needed to ensure continued growth in the helicopter industry.

78N32819*# ISSUE 23 PAGE 3137 CATEGORY 71
78/08/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Noise requirements from a military point of view
AUTH: A/CRAWFORD, C. C., JR.
CORP: Army Aviation Research and Development Command, St. Louis, Mo. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 33-44 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*MILITARY HELICOPTERS/*NOISE POLLUTION/*POLLUTION CONTROL
MINS: / AIRCRAFT PERFORMANCE/ COST EFFECTIVENESS/ HELICOPTER DESIGN/ NOISE REDUCTION/ STANDARDS
ABA: J.M.S.
ABS: External and internal aircraft noise requirements are discussed in terms of application to military helicopters. The impact of the application of noise reduction technology to comply with FAA standards on cost and performance is emphasized.

78N32818*# ISSUE 23 PAGE 3136 CATEGORY 71
78/08/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter noise regulations: An industry perspective
AUTH: A/WAGNER, R. A.
CORP: Helicopter Association of America, Washington, D. C. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 17-32 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE POLLUTION/*POLLUTION CONTROL
MINS: / AIRCRAFT INDUSTRY/ GOVERNMENT/INDUSTRY RELATIONS/ NOISE REDUCTION/ REGULATIONS/ STANDARDS/ TECHNOLOGY ASSESSMENT
ABA: J.M.S.
ABS: A review of helicopter noise measurement programs and noise reduction/economic studies of FAA is given along with a critique of a study which addresses the economic impact of noise reduction on helicopter noise. Modification of several helicopters to reduce noise and demonstrate the economic impact of the application of the current state-of-the-art technology is discussed. Specific helicopters described include Boeing Vertol 347 Helicopter, Hughes OH-6 Helicopter, and Hughes 269C Helicopter. Other topics covered include: (1) noise trends and possible noise limits; (2) accuracy of helicopter noise prediction techniques; (3) limited change possibilities of derivatives; and (4) rotor impulsive noise. The unique operational capabilities of helicopters and the implications relative to noise regulations and certification are discussed.

78N32817*# ISSUE 23 PAGE 3136 CATEGORY 71
78/08/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter external noise requirements: FAA perspective
AUTH: A/FOSTER, C. R.
CORP: Federal Aviation Administration, Washington, D.C. AVAIL.NTIS SAP: HC A17/MF A01
In NASA. Langley Res. Center Helicopter Acoustics p 1-16 (SEE N78-32816 23-71)
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE POLLUTION/*POLLUTION CONTROL
MINS: / ENVIRONMENT PROTECTION/ GOVERNMENT/INDUSTRY RELATIONS/ HELICOPTER DESIGN/ NOISE REDUCTION/ RESIDENTIAL AREAS/ STANDARDS
ABA: J.M.S.
ABS: Enactment of helicopter noise certification standards for the control of noise impact contributing to community annoyance is considered in terms of the development of helicopters as an environmentally compatible air transportation mode. Increased use of helicopters for commercial applications and public awareness of aircraft noise are cited as factors making development of helicopter noise standards necessary both for the protection of the environmental interest of the community and to ensure the orderly growth of the helicopter industry itself. Noise sources, technology trends in helicopter design, and design concepts to control helicopter noise are discussed along with the regulatory background and specific helicopter regulatory concepts.

78N32486*# ISSUE 23 PAGE 3092 CATEGORY 39
78/10/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Dynamic analysis using superelements for a large helicopter model
AUTH: A/PATEL, M. P.; B/SHAH, L. C. PAA: B/(Multiple Access Inc.)
CORP: Hughes Helicopters, Culver City, Calif. AVAIL.NTIS SAP: HC A21/MF A01
In NASA. Marshall Space Flight Center Seventh NASTRAN User's Colloq. p 335-354 (SEE N78-32466 23-39)
MAJS: /*AIRCRAFT MODELS/*DYNAMIC STRUCTURAL ANALYSIS/*HELICOPTERS
MINS: / NASTRAN/ STRESS ANALYSIS/ SUBSTRUCTURES
ABA: J.A.M.
ABS: Using superelements (substructures), modal and frequency response analysis was performed for a large model of the Advanced Attack Helicopter developed for the U.S. Army. Whiffletree concept was employed so that the residual structure along with the various superelements could be represented as beam-like structures for economical and accurate dynamic

analysis. A very large DMAP alter to the rigid format was developed so that the modal analysis, the frequency response, and the strain energy in each component could be computed in the same run.

78N30139*# ISSUE 21 PAGE 2762 CATEGORY 8 RPT#: NASA-CR-158909 CNT#: NSG-1114 78/07/00 55 PAGES UNCLASSIFIED DOCUMENT

UTTL: Structural dynamics, stability, and control of helicopters
AUTH: A/MEIROVITCH, L.; B/HALE, A. L.
CORP: Virginia Polytechnic Inst. and State Univ., Blacksburg. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*DYNAMIC STRUCTURAL ANALYSIS/*HELICOPTERS/* MATHEMATICAL MODELS
MINS: / ANALYSIS (MATHEMATICS)/ COMPUTER PROGRAMS/ GYROSCOPIC STABILITY/ STRUCTURAL STABILITY
ABA: Author
ABS: The dynamic synthesis of gyroscopic structures consisting of point-connected substructures is investigated. The objective is to develop a mathematical model capable of an adequate simulation of the modal characteristics of a helicopter using a minimum number of degrees of freedom. The basic approach is to regard the helicopter structure as an assemblage of flexible substructures. The variational equations for the perturbed motion about certain equilibrium solutions are derived. The discretized variational equations can be conveniently exhibited in matrix form, and a great deal of information about the system modal characteristics can be extracted from the coefficient matrices. The derivation of the variational equations requires a monumental amount of algebraic operations. To automate this task a symbolic manipulation program on a digital computer is developed.

78N30044*# ISSUE 21 PAGE 2749 CATEGORY 2 RPT#: NASA-CR-145333 LR-28435-VOL-3 CNT#: NAS1-14570 78/06/00 3 VOLS 247 PAGES UNCLASSIFIED DOCUMENT

UTTL: REXOR 2 rotorcraft simulation model. Volume 3: User's manual TLSP: Final Technical Report
AUTH: A/REASER, J. S.; B/KRETSINGER, P. H.
CORP: Lockheed-California Co., Burbank. AVAIL.NTIS SAP: HC A11/MF A01
Sponsored in part by AVRADCOM
MAJS: /*COMPUTERIZED SIMULATION/*INPUT/OUTPUT ROUTINES/* ROTORCRAFT AIRCRAFT/*USER MANUALS (COMPUTER PROGRAMS)
MINS: / AERODYNAMICS/ AIRFOILS/ COMPUTER PROGRAMS/ DATA PROCESSING/ HELICOPTERS/ OPERATING SYSTEMS (COMPUTERS)
ABS: For abstract, see N78-30042.

78N30043*# ISSUE 21 PAGE 2749 CATEGORY 2 RPT#: NASA-CR-145332 LR-28435-VOL-2 CNT#: NAS1-14570 78/06/00 3 VOLS 177 PAGES UNCLASSIFIED DOCUMENT

UTTL: REXOR 2 rotorcraft simulation model. Volume 2: Computer implementation TLSP: Final Technical Report
AUTH: A/REASER, J. S.; B/KRETSINGER, P. H.
CORP: Lockheed-California Co., Burbank. AVAIL.NTIS SAP: HC A09/MF A01
Sponsored in part by Avradcom
MAJS: /*AIRFOILS/*COMPUTER PROGRAMS/*COMPUTERIZED SIMULATION /*EQUATIONS OF MOTION/*ROTORCRAFT AIRCRAFT
MINS: / CODING/ COMPUTER PROGRAMMING/ DIGITAL COMPUTERS/ HELICOPTERS/ MATRICES (MATHEMATICS)/ NONLINEAR PROGRAMMING
ABS: For abstract, see N78-30042.

78N30042*# ISSUE 21 PAGE 2749 CATEGORY 2 RPT#: NASA-CR-145331 LR-28435-VOL-1 CNT#: NAS1-14570 78/06/00 3 VOLS 272 PAGES UNCLASSIFIED DOCUMENT

UTTL: REXOR 2 rotorcraft simulation model. Volume 1: Engineering documentation TLSP: Final Technical Report
AUTH: A/REASER, J. S.; B/KRETSINGER, P. H.
CORP: Lockheed-California Co., Burbank. AVAIL.NTIS SAP: HC A12/MF A01
Sponsored in part by AVRADCOM
MAJS: /*AIRFOILS/*COMPUTER PROGRAMS/*COMPUTERIZED SIMULATION /*ROTORCRAFT AIRCRAFT
MINS: / AERODYNAMICS/ CONTROL/ DIGITAL COMPUTERS/ EQUATIONS OF MOTION/ HELICOPTERS/ NONLINEAR PROGRAMMING
ABA: G.Y.
ABS: A rotorcraft nonlinear simulation called REXOR II, divided into three volumes, is described. The first volume is a development of rotorcraft mechanics and aerodynamics. The second is a development and explanation of the computer code required to implement the equations of motion. The third volume is a user's manual, and contains a description of code input/output as well as operating instructions.

78N29083*# ISSUE 20 PAGE 2622 CATEGORY 5 RPT#: NASA-CR-145377 D210-11278-1 CNT#: NAS1-13624 78/08/00 52 PAGES UNCLASSIFIED DOCUMENT

UTTL: Civil helicopter design and operational requirement
AUTH: A/WATERS, M. T.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*AIRCRAFT INDUSTRY/*CIVIL AVIATION/*HELICOPTER DESIGN /*PASSENGER AIRCRAFT/*SOCIAL FACTORS
MINS: / AIRCRAFT SAFETY/ COST REDUCTION/ FUEL CONSUMPTION/ HELICOPTER PERFORMANCE/ LAND USE/ LIFE CYCLE COSTS/ MILITARY HELICOPTERS

ABA: A.R.H.
ABS: Design and operational requirements and other factors that have a restraining influence on expansion of the helicopter market are discussed. The needs of operators, users, pilots and the community at large are examined. The impact of future technology developments and other trends such as use, energy shortages, and civil and military helicopter requirements and development is assessed. Areas where research and development are needed to provide opportunities for lowering life cycle costs and removing barriers to further expansion of the industry are analyzed.

78N29082*# ISSUE 20 PAGE 2622 CATEGORY 5 RPT#: NASA-CR-145379 CNT#: NAS1-13624 78/08/00 58 PAGES UNCLASSIFIED DOCUMENT
UTTL: Research requirements to reduce civil helicopter life cycle cost
AUTH: A/BLEWITT, S. J.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*AIRCRAFT INDUSTRY/*CIVIL AVIATION/*COST REDUCTION/*HELICOPTERS/*LIFE CYCLE COSTS/*RESEARCH AND DEVELOPMENT
MINS: / MAINTENANCE/ PASSENGER AIRCRAFT/ PRODUCTION ENGINEERING/ PRODUCTION MANAGEMENT/ RELIABILITY ENGINEERING
ABA: A.R.H.
ABS: The problem of the high cost of helicopter development, production, operation, and maintenance is defined and the cost drivers are identified. Helicopter life cycle costs would decrease by about 17 percent if currently available technology were applied. With advanced technology, a reduction of about 30 percent in helicopter life cycle costs is projected. Technological and managerial deficiencies which contribute to high costs are examined, basic research and development projects which can reduce costs include methods for reduced fuel consumption; improved turbine engines; airframe and engine production methods; safety; rotor systems; and advanced transmission systems.

78N27429*# ISSUE 18 PAGE 2396 CATEGORY 37 RPT#: NASA-CR-135195 SKF-AL771021 CNT#: NAS3-17343 78/01/00 125 PAGES UNCLASSIFIED DOCUMENT
UTTL: Emergency and microfog lubrication and cooling of bearings for Army helicopters TLSP: Final Report, Dec. 1972 - Jun. 1977
AUTH: A/ROSENLIEB, J. W.
CORP: SKF Industries, Inc., King of Prussia, Pa. CSS: (Research Lab.) AVAIL.NTIS SAP: HC A06/MF A01
MAJS: /*AIR COOLING/*BEARINGS/*HELICOPTERS/*LUBRICATION
MINS: / COOLING SYSTEMS/ LUBRICATING OILS/ LUBRICATION SYSTEMS/ MIST/ SYSTEMS ENGINEERING
ABA: Author
ABS: An analysis and system study was performed to provide design information regarding lubricant and coolant flow rates and flow paths for effective utilization of the lubricant and coolant in a once-through oil-mist (microfog) and coolant air system. A system was designed, manufactured, coupled with an existing rig and evaluation tests were performed using 46 mm bore split-inner angular-contact ball bearings under 1779N (400 lb.) thrust load. An emergency lubrication aspirator system was also manufactured and tested under lost lubricant conditions. The testing demonstrated the feasibility of using a mist oil and cooling air system to lubricate and cool a high speed helicopter engine mainshaft bearing. The testing also demonstrated the feasibility of using an emergency aspirator lubrication system as a viable survivability concept for helicopter mainshaft engine bearing for periods as long as 30 minutes.

78N25832*# ISSUE 16 PAGE 2174 CATEGORY 71 RPT#: NASA-CR-152150 MIT-78-2 CNT#: NSG-2142 78/03/00 94 PAGES UNCLASSIFIED DOCUMENT
UTTL: The effect of tip vortex structure on helicopter noise due to blade/vortex interaction
AUTH: A/WOLF, T. L.; B/WIDNALL, S. E.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Fluid Dynamics Research Lab.) AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*AERODYNAMIC NOISE/*BLADE TIPS/*HELICOPTERS/*NOISE MEASUREMENT/*ROTARY WINGS/*VORTICES
MINS: / GAS-SOLID INTERFACES/ ROTOR LIFT/ UNSTEADY FLOW/ VELOCITY DISTRIBUTION
ABA: Author
ABS: A potential cause of helicopter impulsive noise, commonly called blade slap, is the unsteady lift fluctuation on a rotor blade due to interaction with the vortex trailed from another blade. The relationship between vortex structure and the intensity of the acoustic signal is investigated. The analysis is based on a theoretical model for blade/vortex interaction. Unsteady lift on the blades due to blade/vortex interaction is calculated using linear unsteady aerodynamic theory, and expressions are derived for the directivity, frequency spectrum, and transient signal of the radiated noise. An inviscid rollup model is used to calculate the velocity profile in the trailing vortex from the spanwise distribution of blade tip loading. A few

cases of tip loading are investigated, and numerical results are presented for the unsteady lift and accustic signal due to blade/vortex interaction. The intensity of the acoustic signal is shown to be quite sensitive to changes in tip vortex structure.

78N25080*# ISSUE 16 PAGE 2075 CATEGORY 5 RPT#: NASA-CR-135081 SER-50959 CNT#: NAS3-18538 76/12/00 52 PAGES UNCLASSIFIED DOCUMENT

UTTL: Oil-air mist lubrication for helicopter gearing TLSP: Final Report

AUTH: A/MCGROGAN, F.

CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*AIR FLOW/*DYNAMIC CHARACTERISTICS/*GEARS/* HELICOPTERS/*LUBRICATING OILS/*LUBRICATION/*MIST

MINS: / ATOMIZING/ CONTINGENCY/ HEAT TRANSFER/ NOZZLE FLOW/ SIKORSKY AIRCRAFT/ TEST EQUIPMENT

ABA: Author

ABS: The applicability of a once-through oil mist system to the lubrication of helicopter spur gears was investigated and compared to conventional jet spray lubrication. In the mist lubrication mode, cooling air was supplied at 366K (200 F) to the out of mesh location of the gear sets. The mist air was also supplied at 366K (200 F) to the radial position mist nozzle at a constant rate of 0.0632 mol/s (3 SCFM) per nozzle. The lubricant contained in the mist air varied between 32 - 44 cc/hour. In the recirculating jet spray mode, the flow rate was varied between 1893 - 2650 cc/hour. Visual inspection revealed the jet spray mode produced a superior surface finish on the gear teeth but a thermal energy survey showed a 15 - 20% increase in heat generated. The gear tooth condition in the mist lubrication mode system could be improved if the cooling air and lubricant/air flow ratio were increased. The test gearbox and the procedure used are described.

78N24903*# ISSUE 15 PAGE 2049 CATEGORY 71 RPT#: NASA-CR-3001 CNT#: NAS1-14192 78/06/00 74 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of the annoyance due to helicopter rotor noise TLSP: Final Report

AUTH: A/STERNFELD, H., JR.; B/DOYLE, L. B.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A03/MF A01 Washington NASA

MAJS: /*HELICOPTERS/*HUMAN TOLERANCES/*NOISE INTENSITY/* ROTARY WINGS

MINS: / AIRCRAFT NOISE/ EFFECTIVE PERCEIVED NOISE LEVELS/ NOISE SPECTRA/ PSYCHOACOUSTICS/ SOUND PRESSURE

ABA: Author

ABS: A program was conducted in which 25 test subjects adjusted the levels of various helicopter rotor spectra until the combination of the harmonic noise and a broadband background noise was judged equally annoying as a higher level of the same broadband noise spectrum. The subjective measure of added harmonic noise was equated to the difference in the two levels of broadband noise. The test participants also made subjective evaluations of the rotor noise signatures which they created. The test stimuli consisted of three degrees of rotor impulsiveness, each presented at four blade passage rates. Each of these 12 harmonic sounds was combined with three broadband spectra and was adjusted to match the annoyance of three different sound pressure levels of broadband noise. Analysis of variance indicated that the important variables were level and impulsiveness. Regression analyses indicated that inclusion of crest factor improved correlation between the subjective measures and various objective or physical measures.

78N22071*# ISSUE 13 PAGE 1660 CATEGORY 4 RPT#: NASA-CR-152140 TR-1092-1 CNT#: NAS2-9392 78/01/00 254 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of automatic and manual flight director landing systems for the XV-15 tilt rotor aircraft in helicopter mode

AUTH: A/HOFMANN, L. G.; B/HOH, R. H.; C/JEWELL, W. F.; D/TEPER, G. L.; E/PATEL, P. D.

CORP: Systems Technology, Inc., Hawthorne, Calif. AVAIL.NTIS SAP: HC A12/MF A01

MAJS: /*AIRCRAFT LANDING/*AUTOMATIC CONTROL/*MANUAL CONTROL /*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*XV-15 AIRCRAFT

MINS: / AIRCRAFT CONTROL/ DIGITAL COMPUTERS/ HELICOPTERS/ SYSTEMS ENGINEERING/ TOUCHDOWN

ABA: Author

ABS: The objective of this effort is to determine IFR approach path and touchdown dispersions for manual and automatic XV-15 tilt rotor landings, and to develop missed approach criteria. Only helicopter mode XV-15 operation is considered. The analysis and design sections develop the automatic and flight director guidance equations for decelerating curved and straight-in approaches into a typical VTOL landing site equipped with an MLS navigation aid. These system designs satisfy all known pilot-centered, guidance and control requirements for this flying task. Performance data, obtained from nonstationary covariance propagation dispersion analysis for the system, are used to develop the approach monitoring criteria. The autoland and flight director guidance equations are programmed for the VSTOLAND 1819B digital computer.

The system design dispersion data developed through analysis and the 18198 digital computer program are verified and refined using the fixed-base, man-in-the-loop XV-15 VSTOLAND simulation.

78N21161*# ISSUE 12 PAGE 1537 CATEGORY 8 RPT#: NASA-CR-152135 REPT-1205 CNT#: NAS2-7187 75/01/00 289 PAGES UNCLASSIFIED DOCUMENT

UTTL: Optimal control theory (OWEM) applied to a helicopter in the hover and approach phase

AUTH: A/BORN, G. J.; B/KAI, T.

CORP: Princeton Univ., N. J. CSS: (Instrumentation and Control Lab.) AVAIL.NTIS SAP: HC A13/MF A01

MAJS: /*APPROACH CONTROL/*CONTROL THEORY/*HELICOPTERS/*HOVERING STABILITY

MINS: / DAMPING/ FEEDBACK CONTROL/ GROUND EFFECT MACHINES/ LINEAR EQUATIONS/ WEIGHT (MASS)

ABA: Author

ABS: A major difficulty in the practical application of linear-quadratic regulator theory is how to choose the weighting matrices in quadratic cost functions. The control system design with optimal weighting matrices was applied to a helicopter in the hover and approach phase. The weighting matrices were calculated to extremize the closed loop total system damping subject to constraints on the determinants. The extremization is really a minimization of the effects of disturbances, and interpreted as a compromise between the generalized system accuracy and the generalized system response speed. The trade-off between the accuracy and the response speed is adjusted by a single parameter, the ratio of determinants. By this approach an objective measure can be obtained for th design of a control system. The measure is to be determined by the system requirements.

78N21093*# ISSUE 12 PAGE 1528 CATEGORY 5 RPT#: NASA-CR-145335 CNT#: NAS1-13624 78/04/00 114 PAGES UNCLASSIFIED DOCUMENT

UTTL: Research requirements to improve reliability of civil helicopters

AUTH: A/DOUGHERTY, J. J., III; B/BARRETT, L. D.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*AIRCRAFT RELIABILITY/*HELICOPTERS/*TECHNOLOGY ASSESSMENT

MINS: / COST ANALYSIS/ FAILURE ANALYSIS/ MAINTAINABILITY

ABA: Author

ABS: The major reliability problems of the civil helicopter fleet as reported by helicopter operational and maintenance personnel are documented. An assessment of each problem is made to determine if the reliability can be improved by application of present technology or whether additional research and development are required. The reliability impact is measured in three ways: (1) The relative frequency of each problem in the fleet. (2) The relative on-aircraft manhours to repair, associated with each fleet problem. (3) The relative cost of repair materials or replacement parts associated with each fleet problem. The data reviewed covered the period of 1971 through 1976 and covered only turbine engine aircraft.

78N20138*# ISSUE 11 PAGE 1398 CATEGORY 8 RPT#: NASA-CR-152079-VOL-3 LR-28200-VOL-3 CNT#: NAS2-9374 78/01/00 3 VOLS 68 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotorcraft linear simulation model. Volume 3: User's manual TLSP: Final Report, Nov. 1976 - Jan. 1978

AUTH: A/REASER, J. S.

CORP: Lockheed-California Co., Burbank. AVAIL.NTIS SAP: HC A04/MF A01

MAJS: /*AIRCRAFT MODELS/*CONTROL SIMULATION/*ROTARY WING AIRCRAFT/*ROTOR AERODYNAMICS/*USER MANUALS (COMPUTER PROGRAMS)

MINS: / CDC COMPUTERS/ FLOW CHARTS/ IBM 360 COMPUTER/ INPUT/OUTPUT ROUTINES/ SUBROUTINES

ABS: For abstract, see N78-20137.

78N20137*# ISSUE 11 PAGE 1397 CATEGORY 8 RPT#: NASA-CR-152079-VOL-2 LR-28200-VOL-2 CNT#: NAS2-9374 78/01/00 3 VOLS 77 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotorcraft linear simulation model. Volume 2: Computer implementation TLSP: Final Report, Nov. 1976 - Jan. 1978

AUTH: A/REASER, J. S.; B/SAIKI, D. H.

CORP: Lockheed-California Co., Burbank. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*AIRCRAFT MODELS/*COMPUTER PROGRAMS/*CONTROL SIMULATION/*ROTARY WING AIRCRAFT/*ROTOR AERODYNAMICS

MINS: / CDC COMPUTERS/ FLOW CHARTS/ IBM 360 COMPUTER/ INPUT/OUTPUT ROUTINES/ SUBROUTINES

ABA: M.V.

ABS: A computer program used to process the equations is presented, and a full description of equation implementation is given. The model was implemented in the IBM 360 and CDC series computer systems.

78N20136*# ISSUE 11 PAGE 1397 CATEGORY 8 RPT#: NASA-CR-152079-VOL-1 LR-28200-VOL-1 CNT#: NAS2-9374 78/01/00 3 VOLS 185 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotorcraft linear simulation model. Volume 1: Engineering documentation TLSP: Final Report, Nov. 1976 - Jan. 1978

AUTH: A/REASER, J. S.
CORP: Lockheed-California Co., Burbank. AVAIL.NTIS SAP: HC A09/MF A01
MAJS: /*AERONAUTICAL ENGINEERING/*AIRCRAFT MODELS/*CONTROL SIMULATION/*EQUATIONS OF MOTION/*ROTARY WING AIRCRAFT /*ROTOR AERODYNAMICS
MINS: / DEGREES OF FREEDOM/ FEATHERING/ FLAPPING/ PERTURBATION/ ROTORS
ABA: Author
ABS: A rotorcraft small perturbation linear model is described. Rotor flap, inplane and feathering degrees of freedom, as well as control and augmentation systems are defined in addition to the classical vehicle six degrees of freedom. The primary application was intended to be an analytic tool to assess the handling qualities of a dynamically combined main rotor and body. The modeling method retained the higher frequency response properties which aided in evaluating control and stability augmentation systems.

78N19630*# ISSUE 10 PAGE 1326 CATEGORY 44
78/00/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Drive train dynamic analysis
AUTH: A/GIANSANTE, N.
CORP: Kaman Aerospace Corp., Bloomfield, Conn. AVAIL.NTIS SAP: HC A13/MF A01
In NASA. Lewis Res. Center Wind Turbine Structural Dyn. p 157-166 (SEE N78-19616 10-44)
MAJS: /*DYNAMIC RESPONSE/*DYNAMIC STRUCTURAL ANALYSIS/* MATHEMATICAL MODELS/*MECHANICAL DRIVES/*WINDPOWERED GENERATORS
MINS: / COMPUTER PROGRAMS/ GEARS/ HELICOPTERS/ TRANSMISSIONS (MACHINE ELEMENTS)/ WINDPOWER UTILIZATION
ABA: Author
ABS: A method for parametric variations in drive train dynamic analysis is described. The method models the individual components of a drive system, forms the appropriate system interface coordinates and, calculates the system dynamic response at particular frequencies. Application of the method for prediction of the dynamic response characteristics of a helicopter transmission, and a comparison of results with test data are also included.

78N19119*# ISSUE 10 PAGE 1257 CATEGORY 5
77/08/00 19 PAGES UNCLASSIFIED DOCUMENT
UTTL: VTOL/Helicopter approach and landing guidance sensors for Navy ship applications
AUTH: A/MIYASHIRO, S. K.; B/MORRIS, F. E.
CORP: Naval Ocean Systems Center, San Diego, Calif. AVAIL.NTIS SAP: HC A23/MF A01
In Naval Postgraduate School Proc. of the Navy/NASA VSTOL Flying Qualities p 495-514 (SEE N78-19095 10-05)
MAJS: /*APPROACH CONTROL/*FLIGHT CHARACTERISTICS/*GUIDANCE SENSORS/*HELICOPTERS/*LANDING AIDS/*V/STOL AIRCRAFT
MINS: / AIR TRAFFIC CONTROL/ ELECTRO-OPTICS/ MAN MACHINE SYSTEMS/ MICROWAVE LANDING SYSTEMS/ SAFETY FACTORS
ABA: J.M.S.
ABS: Approach and landing guidance sensors essential to recover V/STOL aircraft and helicopter on ships are described. Alternative techniques which feature different operating frequencies from microwave to optical-infrared, different geometric techniques of position fixing by range and angle measurements from a single point or points on a short baseline available at the landing platform typically forty feet wide are included. Other factors discussed include ceiling/visibility requirements, in-close accuracy, safety and pilot acceptance, and compatibility with air traffic control and landing systems.

78N17990*# ISSUE 9 PAGE 1103 CATEGORY 1 RPT#: NASA-CR-145288 CNT#: NAS1-13624 78/02/00 62 PAGES UNCLASSIFIED DOCUMENT
UTTL: Research requirements to reduce maintenance costs of civil helicopters
AUTH: A/MILLION, D. J.; B/WATERS, K. T.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*AIRCRAFT MAINTENANCE/*COST REDUCTION/*HELICOPTERS/* RESEARCH MANAGEMENT
MINS: / AIRCRAFT RELIABILITY/ CIVIL AVIATION/ HELICOPTER DESIGN/ HELICOPTER PERFORMANCE/ TECHNOLOGY UTILIZATION
ABA: Author
ABS: The maintenance problems faced by the operators of civil helicopters that result in high costs are documented. Existing technology that can be applied to reduce maintenance costs and research that should be carried out were identified. Good design practice and application of existing technology were described as having a significant impact on reducing maintenance costs immediately. The research and development that have potential for long range reduction of maintenance costs are presented.

78N17390*# ISSUE 8 PAGE 1025 CATEGORY 37 RPT#: NASA-CR-135502 CNT#: NAS3-20598 77/10/00 38 PAGES UNCLASSIFIED DOCUMENT
UTTL: Feasibility study of negative lift circumferential type seal for helicopter transmissions
AUTH: A/GOLDRING, E. N.
CORP: Stein Seal Co., Philadelphia, Pa. AVAIL.NTIS SAP:

HC A03/MF A01
MAJS: /*FEASIBILITY ANALYSIS/*HELICOPTER PERFORMANCE/*SEALS (STOPPERS)/*TRANSMISSIONS (MACHINE ELEMENTS)
MINS: / LEAKAGE/ PERFORMANCE TESTS/ SIMULATION/ WEAR TESTS
ABA: Author
ABS: A new seal concept, the negative lift circumferential type seal, was evaluated under simulated helicopter transmission conditions. The bore of the circumferential seal contains step type geometry which produces a negative lift that urges the sealing segments towards the shaft surface. The seal size was a 2.5 inch bore and the test speeds were 7000 and 14,250 rpm. During the 300 hour test at typical transmission seal pressure (to 2 psig) the leakage was within acceptable limits and generally less than 0.1 cc/hour during the last 150 hours of testing. The wear to the carbon segments during the 300 hours was negligible.

78N16026*# ISSUE 7 PAGE 840 CATEGORY 3 RPT#: NASA-CR-145260 CNT#: NAS1-13624 77/11/00 77 PAGES UNCLASSIFIED DOCUMENT
UTTL: Research requirements to improve safety of civil helicopters
AUTH: A/WATERS, K. T.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*AIRCRAFT SAFETY/*CIVIL AVIATION/*HELICOPTERS/*RESEARCH MANAGEMENT/*SAFETY MANAGEMENT/*TECHNOLOGY ASSESSMENT
MINS: / ACCIDENT INVESTIGATION/ COST EFFECTIVENESS/ HUMAN FACTORS ENGINEERING/ MANAGEMENT PLANNING/ RESEARCH AND DEVELOPMENT
ABA: Author
ABS: Helicopter and fixed-wing accident data were reviewed and major accident causal factors were established. The impact of accidents on insurance rates was examined and the differences in fixed-wing and helicopter accident costs discussed. The state of the art in civil helicopter safety was compared to military helicopters. Goals were established based on incorporation of known technology and achievable improvements that require development, as well as administrative-type changes such as the impact of improved operational planning, training, and human factors effects. Specific R and D recommendations are provided with an estimation of the payoffs, timing, and development costs.

78N16003*# ISSUE 7 PAGE 837 CATEGORY 2 RPT#: NASA-CR-2914 D210-11188-1-VOL-1 CNT#: NAS1-13795 77/12/00 163 PAGES UNCLASSIFIED DOCUMENT
UTTL: Two-dimensional wind tunnel test of an oscillating rotor airfoil, volume 1 TLSP: Final Report
AUTH: A/DADONE, L. U.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A08/MF A01
MAJS: /*AIRFOILS/*ROTARY WINGS/*WIND TUNNEL TESTS/*WIND TUNNELS/*WING OSCILLATIONS
MINS: / HELICOPTERS/ MACH NUMBER/ OSCILLATIONS/ PITCH (INCLINATION)/ PRESSURE MEASUREMENT
ABA: Author
ABS: A two dimensional wind tunnel test was conducted to obtain the quasisteady and unsteady characteristics of an advanced airfoil designed for helicopter rotor applications. Differential pressures were measured at 17 locations along the chord of the airfoil model. The airfoil motions were sinusoidal forced-pitch oscillations about the quarter chord at amplitudes varying from 2.5 to 10.0 degrees and at frequencies from 23 Hz to 90 Hz. The quasisteady tests were conducted at Mach numbers from 0.2 to 0.9, and the oscillatory tests between M = 0.2 and M = 0.7. At quasisteady conditions a limited number of drag measurements were made with a wake-traversing probe.

78N13007*# ISSUE 4 PAGE 422 CATEGORY 2 RPT#: NASA-CR-152053 AS1-TR-76-28 CNT#: NAS2-8671 77/06/00 141 PAGES UNCLASSIFIED DOCUMENT
UTTL: Aerodynamic interference effects on tilting proprotor aircraft --- using the Green function method TLSP: Final Technical Report, Oct. 1975 - May 1977
AUTH: A/SOOHOO, P.; B/MORINO, L.; C/NOLL, R. B.; D/HAM, N. D. PAA: B/(Boston Univ.); D/(MIT, Cambridge)
CORP: Aerospace Systems, Inc., Burlington, Mass. AVAIL.NTIS SAP: HC A07/MF A01
MAJS: /*AERODYNAMIC INTERFERENCE/*GREEN FUNCTION/*RESEARCH AIRCRAFT/*TILT ROTOR AIRCRAFT/*TILTING ROTORS
MINS: / ACTUATOR DISKS/ AIRCRAFT WAKES/ BODY-WING AND TAIL CONFIGURATIONS/ INCOMPRESSIBLE FLOW/ INTEGRAL EQUATIONS/ PRESSURE DISTRIBUTION
ABA: A.H.
ABS: The Green's function method was used to study tilting proprotor aircraft aerodynamics with particular application to the problem of the mutual interference of the wing-fuselage-tail-rotor wake configuration. While the formulation is valid for fully unsteady rotor aerodynamics, attention was directed to steady state aerodynamics, which was achieved by replacing the rotor with the actuator disk approximation. The use of an actuator disk analysis introduced a mathematical singularity into the formulation; this

problem was studied and resolved. The pressure distribution, lift, and pitching moment were obtained for an XV-15 wing-fuselage-tail rotor configuration at various flight conditions. For the flight configurations explored, the effects of the rotor wake interference on the XV-15 tilt rotor aircraft yielded a reduction in the total lift and an increase in the nose-down pitching moment. This method provides an analytical capability that is simple to apply and can be used to investigate fuselage-tail rotor wake interference as well as to explore other rotor design problem areas.

78N12472*# ISSUE 3 PAGE 348 CATEGORY 39
77/C0/00 20 PAGES UNCLASSIFIED DOCUMENT
UTTL: Addition of rigid elements to NASTRAN
AUTH: A/PAMIDI, P. R.; B/RONKHITE, J. D. PAA: B/(Bell Helicopter Textron)
CORP: Computer Sciences Corp., Hampton, Va. AVAIL.NTIS SAP: HC A20/MF A01
In NASA, Washington Sixth NASTRAN Users' Colloq. p 449-468 (SEE N78-12443 03-39)
MAJS: /*COMPUTER PROGRAMS/*NASTRAN/*RIGID STRUCTURES
MINS: / DATA PROCESSING/ HELICOPTERS/ INFORMATION SYSTEMS/ STRUCTURAL ANALYSIS
ABA: Author
ABS: Four rigid elements, namely, a rigid rod element (CRIGDR) and three rigid body elements (CRIGD1, GRIGD2 and CRIGD3), have recently been added to NASTRAN and will be available in the next public release of the program. The theoretical formulation, the bulk data information and the programming details pertaining and realistic problems are illustrated by employing them in the solution of two helicopter structural analysis problems.

78N11519*# ISSUE 2 PAGE 215 CATEGORY 45 RPT#: NASA-CR-145238 CNT#: NSG-1121 77/08/00 62 PAGES UNCLASSIFIED DOCUMENT
UTTL: The environmental analysis of helicopter operations by Federal agencies: Current procedures and research needs
AUTH: A/SMITH, C. C.; B/WARNER, D. B.; C/DAJANI, J. S.
CORP: Duke Univ., Durham, N. C. CSS: (Duke Environmental Center.) AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*CIVIL AVIATION/*ECONOMICS/*ENVIRONMENTAL SURVEYS/*HELICOPTERS
MINS: / ECONOMIC FACTORS/ GOVERNMENTS/ MODELS
ABA: Author
ABS: The technical, economic, and environmental problems restricting commercial helicopter passenger operations are reviewed. The key considerations for effective assessment procedures are outlined and a preliminary model for the environmental analysis of helicopters is developed. It is recommended that this model, or some similar approach, be used as a common base for the development of comprehensive environmental assessment methods for each of the federal agencies concerned with helicopters. A description of the critical environmental research issues applicable to helicopters is also presented.

78N10117*# ISSUE 1 PAGE 18 CATEGORY 9 RPT#: NASA-CR-152066 TR-1097-1 CNT#: NAS2-9421 77/09/00 59 PAGES UNCLASSIFIED DOCUMENT
UTTL: The determination of some requirements for a helicopter flight research simulation facility
AUTH: A/SINACORI, J. B.
CORP: Systems Technology, Inc., Mountain View, Calif. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*FLIGHT SIMULATION/*HELICOPTERS/*SYSTEMS ENGINEERING /*TEST FACILITIES
MINS: / AERODYNAMICS/ RESEARCH FACILITIES/ RESEARCH MANAGEMENT
ABA: Author
ABS: Important requirements were defined for a flight simulation facility to support Army helicopter development. In particular requirements associated with the visual and motion subsystems of the planned simulator were studied. The method used in the motion requirements study is presented together with the underlying assumptions and a description of the supporting data. Results are given in a form suitable for use in a preliminary design. Visual requirements associated with a television camera/model concept are related. The important parameters are described together with substantiating data and assumptions. Research recommendations are given.

78N10046*# ISSUE 1 PAGE 7 CATEGORY 5 RPT#: NASA-CR-152034 D210-11255-1 AD-A051306 CNT#: NAS2-8048 77/06/00 43 PAGES UNCLASSIFIED DOCUMENT
UTTL: Pilot evaluation of an advanced hingeless rotor XV-15 simulation
AUTH: A/MCVEIGH, M. A.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*FLIGHT SIMULATION/*PERFORMANCE PREDICTION/*TILT ROTOR AIRCRAFT/*XV-15 AIRCRAFT
MINS: / AERONAUTICAL ENGINEERING/ MATHEMATICAL MODELS/ RIGID ROTORS/ TEST PILOTS
ABA: Author
ABS: A piloted simulation of an advanced hingeless rotor XV-15 tilt-rotor aircraft was carried out. The

evaluation was made by a pilot from NASA-Ames who had previous experience flying a simulation of the current gimballed rotor NASA/Army XV-15. It was pointed out that some modifications to the force feel system were needed in order to provide rapid force trimming during rapid maneuvers. Some additional tailoring of the SCAS system was required to achieve good nap-of-the-earth performance. Overall pilot opinion on the hingeless rotor XV-15 tilt rotor was favorable. Brief discussion on the mathematical models and the simulator configuration are presented. The maneuvers and pilot comments are given along with some engineering comments.

77N33129*# ISSUE 24 PAGE 3169 CATEGORY 3 RPT#: NASA-TT-F-17444 CNT#: NASW-2791 77/08/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: Notes on the pollution of airplanes and helicopters by chemicals during agricultural jobs

AUTH: A/STRASZEWSKI, B.

CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS SAP: HC A02/MF A01 Washington NASA Presented at Ergonomics in Aviat: 1st Natl. Sci. Technol. Conf., Warsaw, 17-19 Mar. 1975 p 326-328 Transl. into ENGLISH of Polish conf. paper

MAJS: /*AGRICULTURE/*AIR POLLUTION/*CABIN ATMOSPHERES/*CONTAMINATION/*FUSELAGES/*SPRAYING

MINS: / CORROSION/ SERVICE LIFE/ TOXIC HAZARDS

ABA: J.M.S.

ABS: Contamination of the fuselage, the pilot's cabin, the engine, and the onboard compressed air installations while spraying agricultural fields is briefly discussed. Corrosion, service life, and exposure of the pilot and service personnel to toxic chemicals are among the factors considered.

77N33128*# ISSUE 24 PAGE 3169 CATEGORY 3 RPT#: NASA-TT-F-17443 CNT#: NASW-2791 77/08/00 21 PAGES UNCLASSIFIED DOCUMENT

Original language document was announced as A76-28551

UTTL: Analysis of air accidents involving airplanes or helicopters of various types of application

AUTH: A/KOSTIA, T.

CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS SAP: HC A02/MF A01 Washington NASA Presented at Ergonomics in Aviat: 1st Natl. Sci. Technol. Conf., Warsaw, 17-19 May 1975 p 266-282 Transl. into ENGLISH of Polish conf. paper

MAJS: /*AIRCRAFT ACCIDENTS/*GENERAL AVIATION AIRCRAFT/*HELICOPTERS/*STATISTICAL ANALYSIS

MINS: / AIRCRAFT DESIGN/ FLIGHT SAFETY

ABA: Author

ABS: The results are presented of a statistical analysis of air accidents involving two- and four-engine communications aircraft and general aviation aircraft up to 5.7 tons, with emphasis on agricultural aircraft, based on the whole on accident statistics published by the Civil Aeronautics Board. The occurrence rate of various kinds of accidents, involving fatalities or not, was calculated, the causes of the accidents are classified and some conclusions are drawn from the results regarding possible directions for future safer designs for general aviation aircraft.

77N32752*# ISSUE 23 PAGE 3119 CATEGORY 61 RPT#: NASA-CR-2877 CNT#: NCA2-OR440-601 77/09/00 112 PAGES UNCLASSIFIED DOCUMENT

UTTL: Computer considerations for real time simulation of a generalized rotor model TLSP: Final Report

AUTH: A/HOWE, R. M.; B/FOGARTY, L. E.

CORP: Michigan Univ., Ann Arbor. CSS: (Dept. of Aerospace Engineering.) AVAIL.NTIS SAP: HC A06/MF A01 Washington NASA

MAJS: /*FLIGHT SIMULATION/*MATHEMATICAL MODELS/*REAL TIME OPERATION/*ROTORS

MINS: / AERODYNAMIC FORCES/ COMPOUND HELICOPTERS/ DIGITAL SIMULATION/ EQUATIONS OF MOTION/ TIME SHARING

ABA: Author

ABS: Scaled equations were developed to meet requirements for real time computer simulation of the rotor system research aircraft. These equations form the basis for consideration of both digital and hybrid mechanization for real time simulation. For all digital simulation estimates of the required speed in terms of equivalent operations per second are developed based on the complexity of the equations and the required intergration frame rates. For both conventional hybrid simulation and hybrid simulation using time-shared analog elements the amount of required equipment is estimated along with a consideration of the dynamic errors. Conventional hybrid mechanization using analog simulation of those rotor equations which involve rotor-spin frequencies (this constitutes the bulk of the equations) requires too much analog equipment. Hybrid simulation using time-sharing techniques for the analog elements appears possible with a reasonable amount of analog equipment. All-digital simulation with affordable general-purpose computers is not possible because of speed limitations, but specially configured digital computers do have the required speed and constitute the recommended approach.

77N31537*# ISSUE 22 PAGE 2950 CATEGORY 39
RPT#: NASA-CR-154987 CNT#: NSG-1143 77/08/00 191 PAGES UNCLASSIFIED DOCUMENT

UTTL: Vibration analysis of rotor blades with an attached concentrated mass TLSP: Technical Report, 1 Jun. - 15 Aug. 1976

AUTH: A/MURTHY, V. R.; B/BARNA, P. S.

CORP: Old Dominion Univ., Norfolk, Va. AVAIL.NTIS SAP: HC A09/MF A01

MAJS: /*MASS DISTRIBUTION/*ROTOR BLADES (TURBOMACHINERY)/*VIBRATORY LOADS

MINS: / COMPUTER PROGRAMS/ HELICOPTERS/ ROTOR AERODYNAMICS/ TORSIONAL VIBRATION

ABA: Author

ABS: The effect of an attached concentrated mass on the dynamics of helicopter rotor blades is determined. The point transmission matrix method was used to define, through three completely automated computer programs, the natural vibrational characteristics (natural frequencies and mode shapes) of rotor blades. The problems of coupled flapwise bending, chordwise bending, and torsional vibration of a twisted nonuniform blade and its special subcase pure torsional vibration are discussed. The orthogonality relations that exist between the natural modes of rotor blades with an attached concentrated mass are derived. The effect of pitch, rotation, and point mass parameters on the collective, cyclic, scissor, and pure torsional modes of a seesaw rotor blade is determined.

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77N30714*# ISSUE 21 PAGE 2837 CATEGORY 52
RPT#: NASA-TT-F-17445 77/07/00 12 PAGES UNCLASSIFIED DOCUMENT
Transl., was announced as A76-20616

UTTL: Evaluation of stress on a pilot during agricultural flights based on physiological studies

AUTH: A/MARKIEWICZ, L.; B/KORADECKA, D.; C/KONARSKA, M.

CORP: Kanner (Leo) Associates, Redwood City, Calif.
AVAIL.NTIS SAP: HC A02/MF A01
Washington NASA Transl. into ENGLISH from Tech. Lotnicza i Astronaut. (Poland), v. 31, no. 1, 1976 p 13-16

MAJS: /*HUMAN FACTORS ENGINEERING/*PILOT PERFORMANCE/*STRESS (PHYSIOLOGY)

MINS: / AGRICULTURE/ AIRCRAFT PILOTS/ STRESS (PSYCHOLOGY)

ABA: Author

ABS: An ergonomic analysis of the development of fatigue in a pilot during agricultural work is presented. Selected indicators of physiological activity during flights on PZL-101 Gawron and An-2 airplanes and MI-2 and SM-2 helicopters are studied under various flight conditions.

77N30444*# ISSUE 21 PAGE 2802 CATEGORY 35
RPT#: NASA-CR-154808 CNT#: NSG-1143 77/08/00 47 PAGES UNCLASSIFIED DOCUMENT

UTTL: Sensor for measuring instantaneous angle of attack of helicopter blades TLSP: Progress Report, Jul. 1976 - Jul. 1977

AUTH: A/BARNA, P. S.; B/LIU, H. W.

CORP: Old Dominion Univ., Norfolk, Va. AVAIL.NTIS SAP: HC A03/MF A01

MAJS: /*ANGLE OF ATTACK/*MEASURING INSTRUMENTS/*ROTARY WINGS

MINS: / HELICOPTERS/ RESEARCH FACILITIES/ ROTOR AERODYNAMICS

ABA: Author

ABS: Various research activities are reported in the following areas: (1) improving and testing probes; (2) theoretical studies of probe motion; and (3) improving research facilities. It is concluded that a satisfactory solution to the problem of measuring angle of attack of helicopter blades may be found in the near future.

77N30067*# ISSUE 21 PAGE 2751 CATEGORY 2
77/00/00 57 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aircraft --- Soviet technology

CORP: Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
AVAIL.NTIS SAP: HC A13/MF A01
In its Soviet Aircraft and Rockets (NASA-TT-F-770) p 24-80 (SEE N77-30065 21-01) Transl. into ENGLISH from the book ""Zankomtes, samolet i raketa'' Moscow, Transport Publishers, 1971

MAJS: /*AERODYNAMICS/*AERONAUTICAL ENGINEERING/*AIRCRAFT DESIGN/*FLIGHT CHARACTERISTICS/*U.S.S.R.

MINS: / AERODYNAMIC HEATING/ AIRCRAFT CONFIGURATIONS/ AIRCRAFT STABILITY/ AIRFOILS/ AVIONICS/ FLOW DISTRIBUTION

ABA: A.R.H.

ABS: The physical principles of flight, and the consideration of atmospheric composition and aerodynamic forces in the design and construction of various types of aircraft are discussed. Flight characteristics are described for helicopters, rotary-wing aircraft, short and vertical takeoff aircraft, and tailless or variable geometry wing aircraft. Flow characteristics at various speeds are also discussed.

77N28113*# ISSUE 19 PAGE 2486 CATEGORY 5 RPT#: NASA-CR-2885 CNT#: NAS2-7806 77/07/00 84 PAGES UNCLASSIFIED DOCUMENT

UTTL: Computers for real time flight simulation: A market survey

AUTH: A/BEKEY, G. A.; B/KARPLUS, W. J.

CORP: Computer Sciences Corp., Mountain View, Calif.

AVAIL.NTIS SAP: HC A05/MF A01
Washington NASA
MAJS: /*COMPUTERS/*FLIGHT SIMULATION/*REAL TIME OPERATION
MINS: / COMPUTATION/ HELICOPTERS/ HIGH FREQUENCIES/ MATHEMATICAL MODELS/ PROBLEM SOLVING
ABA: Author
ABS: An extensive computer market survey was made to determine those available systems suitable for current and future flight simulation studies at Ames Research Center. The primary requirement is for the computation of relatively high frequency content (5 Hz) math models representing powered lift flight vehicles. The Rotor Systems Research Aircraft (RSRA) was used as a benchmark vehicle for computation comparison studies. The general nature of helicopter simulations and a description of the benchmark model are presented, and some of the sources of simulation difficulties are examined. A description of various applicable computer architectures is presented, along with detailed discussions of leading candidate systems and comparisons between them.

77N28063*# ISSUE 19 PAGE 2479 CATEGORY 1 RPT#: NASA-CR-152003 CNT#: NAS2-9143 77/06/00 159 PAGES UNCLASSIFIED DOCUMENT
UTTL: Maintenance cost study of rotary wing aircraft
CORP: Rail Co., Baltimore, Md. AVAIL.NTIS SAP: HC A08/MF A01
MAJS: /*AIRCRAFT MAINTENANCE/*COST ANALYSIS/*ROTARY WINGS
MINS: / FEASIBILITY ANALYSIS/ HELICOPTER DESIGN/ REGRESSION ANALYSIS/ STATISTICAL ANALYSIS
ABA: F.O.S.
ABS: The feasibility was studied of predicting rotary wing operation maintenance costs by using several aircraft design factors for the aircraft dynamic systems. The dynamic systems considered were engines, drives and transmissions, rotors, and flight controls. Multiple regression analysis was used to correlate aircraft design and operational factors with manhours per flight hour, and equations for each dynamic system were developed. Results of labor predictions using the equations compare favorably with actual values.

77N27879*# ISSUE 18 PAGE 2450 CATEGORY 71 RPT#: NASA-CR-151997 CNT#: NSG-2095 77/01/00 28 PAGES UNCLASSIFIED DOCUMENT
UTTL: A computer program for the identification of helicopter impulsive noise sources
AUTH: A/LEE, A.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Fluid Dynamics Research Lab.) AVAIL.NTIS SAP: HC A03/MF A01
MAJS: /*ALGORITHMS/*COMPUTER PROGRAMS/*HELICOPTERS/*IMPULSE GENERATORS/*NOISE MEASUREMENT/*SOUND LOCALIZATION
MINS: / CDC 7600 COMPUTER/ DATA ACQUISITION/ FORTRAN/ MICROPHONES/ ROTARY WINGS/ TRIANGULATION
ABA: Author
ABS: A computer program is presented for calculating the source location of implusive noise in helicopters. The program (INSL) is written in FORTRAN for the CDC 7600 computer. Inputs are the rotor operating conditions and the time intervals (T) between rotor 1/rev index and impulsive noises as measured by different microphones. The outputs are the possible noise source locations in terms of rotor radial and azimuthal coordinates. Typical computer time for a run of six microphone measurements is 1.5 sec, and the cost is about 12 cents for the CDC 7600.

77N27104*# ISSUE 18 PAGE 2348 CATEGORY 5 RPT#: NASA-CR-144953A CNT#: NAS1-13624 76/12/00 22 PAGES UNCLASSIFIED DOCUMENT
UTTL: Identifying and analyzing methods for reducing the energy consumption of helicopters
AUTH: A/DAVIS, S. J.; B/ROSENSTEIN, H. J.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A02/MF A01
MAJS: /*ENERGY CONSUMPTION/*ENERGY POLICY/*HELICOPTERS/*TECHNOLOGY UTILIZATION
MINS: / DRAG REDUCTION/ ENERGY CONSERVATION/ ROTARY WING AIRCRAFT/ TECHNOLOGY ASSESSMENT
ABA: Author
ABS: Reductions in helicopter energy consumption can be accomplished through the use of advanced technology in the areas of powerplant design, improved rotor efficiency, reduced parasite drag, and reduced structural empty weight. Baseline helicopters incorporating technology were designed for a short range (200 n mi) and a very short haul (100 n mi) mission scenario. Parametric analyses were then conducted to determine the impact of technology improvement. Many of the parameters varied are interrelated. A summary of such interactions is presented, and some additional sensitivity values were added so that energy reduction and DOC as affected by the major technological factors or operational modes are clearly defined.

77N27087*# ISSUE 18 PAGE 2346 CATEGORY 3 RPT#: NASA-CR-145224 CNT#: NSG-1121 77/03/00 94 PAGES UNCLASSIFIED DOCUMENT
UTTL: The potential for helicopter passenger service in major urban areas --- cost analysis
AUTH: A/DAJANI, J. S.; B/STORTSTROM, R. G.; C/WARNER, D.

B.
CORP: Duke Univ., Durham, N. C. CSS: (Dept. of Civil Engineering.) AVAIL.NTIS SAP: HC A05/MF A01
MAJS: /*COST ANALYSIS/*HELICOPTERS/*MATHEMATICAL MODELS/* PASSENGER AIRCRAFT/*URBAN TRANSPORTATION
MINS: / CITIES/ COMPUTER PROGRAMS/ ECONOMIC ANALYSIS/ MARKET RESEARCH/ OPERATIONS RESEARCH/ URBAN PLANNING
ABA: Author
ABS: An interurban helicopter cost model having the capability of selecting an efficient helicopter network for a given city in terms of service and total operating costs was developed. This model which is based upon the relationship between total and direct operating costs and the number of block hours of helicopter operation is compiled in terms of a computer program which simulates the operation of an intracity helicopter fleet over a given network. When applied to specific urban areas, the model produces results in terms of a break-even air passenger market penetration rate, which is the percent of the air travelers in each of those areas that must patronize the helicopter network to make it break even commercially. A total of twenty major metropolitan areas are analyzed and are ranked initially according to cost per seat mile and then according to break-even penetration rate.

77N26121*# ISSUE 17 PAGE 2216 CATEGORY 5 RPT#: NASA-CR-145117 CNT#: NAS1-13624 76/12/00 58 PAGES UNCLASSIFIED DOCUMENT
UTTL: Research requirements for development of improved helicopter rotor efficiency
AUTH: A/DAVIS, S. J.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*HELICOPTER PERFORMANCE/*HELICOPTER PROPELLER DRIVE/* ROTARY WINGS/*STRUCTURAL DESIGN
MINS: / CIVIL AVIATION/ COST ESTIMATES/ CRUISING FLIGHT/ HOVERING STABILITY/ RESEARCH AND DEVELOPMENT
ABA: Author
ABS: The research requirements for developing an improved-efficiency rotor for a civil helicopter are documented. The various design parameters affecting the hover and cruise efficiency of a rotor are surveyed, and the parameters capable of producing the greatest potential improvement are identified. Research and development programs to achieve these improvements are defined, and estimated costs and schedules are presented. Interaction of the improved efficiency rotor with other technological goals for an advanced civil helicopter is noted, including its impact on engine noise, hover and cruise performance, one-engine-inoperative hover capability, and maintenance and reliability.

77N25151*# ISSUE 16 PAGE 2084 CATEGORY 5 RPT#: NASA-CR-153247 AD-A033425 USAAMRDL-CR-76-2 D210-11097-1-VOL-1 CNT#: NAS2-8637 76/05/31 295 PAGES UNCLASSIFIED DOCUMENT
UTTL: US Army helicopter design datcom. Volume 1: Airfoils
TLSP: Final Report
AUTH: A/DADONE, L. U.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A13/MF A01
MAJS: /*AERODYNAMIC CHARACTERISTICS/*AIRFOILS/*ROTARY WING AIRCRAFT/*SUPERCRITICAL FLOW
MINS: / ANGLE OF ATTACK/ MACH NUMBER/ PITCH (INCLINATION)/ TABLES (DATA)
ABA: GRA
ABS: This report contains airfoil data of interest for rotor applications. The data is presented in the form of lift, drag, and pitching moment coefficients and, in most cases, it covers the complete Mach number range from low subsonic to supercritical flow conditions. An introductory section presents airfoil data trends and information pertaining to the source and usefulness of such data.

77N25080*# ISSUE 16 PAGE 2074 CATEGORY 2 RPT#: NASA-CR-145195 SRL-14-76-2 CNT#: NAS1-14129 77/05/00 53 PAGES UNCLASSIFIED DOCUMENT
UTTL: Wind tunnel tests of a two bladed model rotor to evaluate the TAMI system in descending forward flight
AUTH: A/WHITE, R. P., JR.
CORP: Systems Research Labs., Inc., Newport News, Va. CSS: (Rasa Div.) AVAIL.NTIS SAP: HC A04/MF A01
MAJS: /*DESCENT TRAJECTORIES/*INJECTORS/*NOISE INTENSITY/* ROTARY WINGS/*WIND TUNNEL TESTS
MINS: / AIRCRAFT SURVIVABILITY/ FLIGHT MECHANICS/ HELICOPTERS/ LOW SPEED/ NOISE REDUCTION
ABA: Author
ABS: A research investigation was conducted to assess the potential of the Tip Air Mass Injection system in reducing the noise output during blade vortex interaction in descending low speed flight. In general it was concluded that the noise output due to blade vortex interaction can be reduced by 4 to 6 db with an equivalent power expenditure of approximately 14 percent of installed power.

77N24343*# ISSUE 15 PAGE 1977 CATEGORY 32
RPT#: NASA-CR-151955 CNT#: NAS2-8799 77/02/00 135 PAGES UNCLASSIFIED DOCUMENT

UTTL: A technique for measuring rotocraft dynamic stability in the 40 by 80 foot wind tunnel TLSP: Interim Report, 16 Jan. 1976 - 15 Jan. 1977

AUTH: A/GUPTA, N. K.; B/BOHN, J. G.

CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS SAP: HC A07/MF A01

MAJS: /*DYNAMIC STABILITY/*TILT ROTOR AIRCRAFT/*WIND TUNNEL TESTS

MINS: / ALGORITHMS/ FLUTTER/ RESONANT FREQUENCIES/ VIBRATION TESTS

ABA: Author

ABS: An on-line technique is described for the measurement of tilt rotor aircraft dynamic stability in the Ames 40- by 80-Foot Wind Tunnel. The technique is based on advanced system identification methodology and uses the instrumental variables approach. It is particulary applicable to real time estimation problems with limited amounts of noise-contaminated data. Several simulations are used to evaluate the algorithm. Estimated natural frequencies and damping ratios are compared with simulation values. The algorithm is also applied to wind tunnel data in an off-line mode. The results are used to develop preliminary guidelines for effective use of the algorithm.

77N24097*# ISSUE 15 PAGE 1943 CATEGORY 5 RPT#: NASA-CR-145167 CNT#: NAS1-13479 77/04/00 118 PAGES UNCLASSIFIED DOCUMENT

UTTL: Study to investigate design, fabrication and test of low cost concepts for large hybrid composite helicopter fuselage, phase 2

AUTH: A/ADAMS, K. M.; B/LUCAS, J. J.

CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS SAP: HC A06/MF A01

MAJS: /*COMPOSITE STRUCTURES/*FUSELAGES/*HELICOPTER DESIGN/* LOW COST

MINS: / AIRFRAMES/ SIKORSKY AIRCRAFT/ SKIN (STRUCTURAL MEMBER)/ STRINGERS

ABA: Author

ABS: The development of a frame/stringer/skin fabrication technique for composite airframe construction was studied as a low cost approach to the manufacturer of larger helicopter airframe components. A center cabin aluminum airframe section of the Sikorsky CH-53D, was selected for evaluation as a composite structure. The design, as developed, is composed of a woven KEVLAR R-49/epoxy skin and graphite/epoxy frames and stringers. The single cure concept is made possible by the utilization of pre-molded foam cores, over which the graphite/epoxy pre-impregnated frame and stringer reinforcements are positioned. Bolted composite channel sections were selected as the optimum joint construction. The applicability of the single cure concept to larger realistic curved airframe sections, and the durability of the composite structure in a realistic spectrum fatigue environment, was described.

77N24055*# ISSUE 15 PAGE 1937 CATEGORY 2 RPT#: NASA-CR-151960 R-1494 CNT#: NAS2-8726 77/01/21 90 PAGES UNCLASSIFIED DOCUMENT

UTTL: Design study of a feedback control system for the Multicyclic Flap System rotor (MFS) TLSP: Final Report

AUTH: A/WEISBRICH, R.; B/PERLEY, R.; C/HOWES, H.

CORP: Kaman Aerospace Corp., Bloomfield, Conn. AVAIL.NTIS SAP: HC A05/MF A01

MAJS: /*AERODYNAMIC CONFIGURATIONS/*FEEDBACK CONTROL/*FLAPS (CONTROL SURFACES)/*HELICOPTER CONTROL/*ROTARY WINGS

MINS: / CIRCUIT DIAGRAMS/ HARMONIC MOTION/ SERVOMECHANISMS/ WIND TUNNEL TESTS

ABA: Author

ABS: The feasibility of automatically providing higher harmonic control to a deflectable control flap at the tip of a helicopter rotor blade through feedback of selected independent parameter was investigated. Control parameters were selected for input to the feedback system. A preliminary circuit was designed to condition the selected parameters, weigh limiting factors, and provide a proper output signal to the multi-cyclic control actuators. Results indicate that feedback control for the higher harmonic is feasible; however, design for a flight system requires an extension of the present analysis which was done for one flight condition - 120 kts, 11,500 lbs gross weight and level flight.

77N23088*# ISSUE 14 PAGE 1806 CATEGORY 5 RPT#: NASA-CR-145225 UVA/528051/ESS77/102 CNT#: NSG-1274 77/05/00 227 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of a research project selection model: Application to a civil helicopter research program TLSP: Final Report

AUTH: A/SCHOULTZ, M. B.; B/JACOBSON, I. D.

CORP: Virginia Univ., Charlottesville. CSS: (School of Engineering and Applied Science.) AVAIL.NTIS

MAJS: /*CIVIL AVIATION/*HELICOPTERS/*MATHEMATICAL MODELS/* PROJECT PLANNING/*RESEARCH MANAGEMENT

MINS: / DECISION MAKING/ DYNAMIC PROGRAMMING/ RESEARCH AND DEVELOPMENT/ VALUE ENGINEERING

ABA: Author

ABS: A model is described for planning and decision making

in research project selection. Evaluations of each project's direct and indirect benefits, uncertainty in achieving these benefits, and schedule priority with resource budget and program balance constraints are considered. The combination of the interactive effect of project selection, resource allocation and scheduling considerations into one model permits tradeoff alternatives to be studied. Clients' value judgments are used in evaluating the benefits from each proposed project. The model is applied to the NASA Civil Helicopter Technology Program. Research project priorities for this program are established, strengths and weaknesses of the model are discussed, and areas of future development are recommended.

77N22177*# ISSUE 13 PAGE 1689 CATEGORY 24
RPT#: NASA-CR-145144 SER-70238-VOL-2 CNT#: NAS1-13882 77/00/00 50 PAGES UNCLASSIFIED DOCUMENT

UTTL: Bearingless helicopter main rotor development. Volume 2: Combined load fatigue evaluation of weathered graphite/epoxy composite TLSP: Final Report, May 1975 - Dec. 1976
AUTH: A/RACKLEWICZ, J. J.
CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS
SAP: HC A03/MF A01
MAJS: /*FATIGUE TESTS/*GRAPHITE/*LOAD TESTS/*ROTARY WINGS
MINS: / COMPOSITE MATERIALS/ EPOXY RESINS/ HELICOPTERS/ LAMINATES
ABA: Author
ABS: Small scale combined load fatigue tests were conducted on six artificially and six naturally weathered test specimens. The test specimen material was unidirectionally oriented A-S graphite - woven glass scrim epoxy resin laminate.

77N21060*# ISSUE 12 PAGE 1543 CATEGORY 5 RPT#: NASA-CR-145114 CNT#: NAS1-13624 76/12/00 79 PAGES UNCLASSIFIED DOCUMENT

UTTL: Research requirements for development of advanced-technology helicopter transmissions --- reduction of maintenance costs
AUTH: A/LEMANSKI, A. J.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
SAP: HC A05/MF A01
MAJS: /*COST REDUCTION/*HELICOPTER ENGINES/*MAINTENANCE/*MECHANICAL DRIVES
MINS: / CIVIL AVIATION/ DESIGN ANALYSIS/ ENGINE PARTS/ SERVICE LIFE
ABA: Author
ABS: Helicopter drive-system technology which would result in the largest benefit in direct maintenance cost when applied to civil helicopters in the 1980 timeframe was developed. A prototype baseline drive system based on 1975 technology provided the basis for comparison against the proposed advanced technology in order to determine the potential for each area recommended for improvement. A specific design example of an advanced-technology main transmission is presented to define improvements for maintainability, weight, producibility, reliability, noise, vibration, and diagnostics. Projections of the technology achievable in the 1980 timeframe are presented. Based on this data, the technologies with the highest payoff (lowest direct maintenance cost) for civil-helicopter drive systems are identified.

77N21041*# ISSUE 12 PAGE 1538 CATEGORY 5
76/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flight flutter testing of rotary wing aircraft using a control system oscillation technique
AUTH: A/YEN, J. G.; B/VISWANATHAN, S.; C/MATTHYS, C. G.
CORP: Bell Helicopter Co., Fort Worth, Tex. AVAIL.NTIS
SAP: HC A21/MF A01
In NASA. Langley Res. Center Flutter Testing Tech. p 501-512 (SEE N77-21022 12-01)
MAJS: /*CONTROL EQUIPMENT/*FLUTTER ANALYSIS/*OSCILLATIONS/*ROTARY WING AIRCRAFT/*ROTOR AERODYNAMICS
MINS: / CONTROL STABILITY/ CORIOLIS EFFECT/ ELASTIC DAMPING/ FOURIER TRANSFORMATION/ VERTICAL TAKEOFF AIRCRAFT/ XV-15 AIRCRAFT
ABA: Author
ABS: A flight flutter testing technique is described in which the rotor controls are oscillated by series actuators to excite the rotor and airframe modes of interest, which are then allowed to decay. The moving block technique is then used to determine the damped frequency and damping variation with rotor speed. The method proved useful for tracking the stability of relatively well damped modes. The results of recently completed flight tests of an experimental soft-in-plane rotor are used to illustrate the technique. Included is a discussion of the application of this technique to investigation of the propeller whirl flutter stability characteristics of the NASA/Army XV-15 VTOL tilt rotor research aircraft.

77N21040*# ISSUE 12 PAGE 1537 CATEGORY 8
76/00/00 27 PAGES UNCLASSIFIED DOCUMENT

UTTL: Investigation of aeroelastic stability phenomena of a helicopter by in-flight shake test
AUTH: A/MIAO, W. L.; B/EDWARDS, T.; C/BRANDT, D. E.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
SAP: HC A21/MF A01

p 473-500 (SEE N77-21022 12-01)
MAJS: /*AERODYNAMIC STABILITY/*AEROELASTICITY/*FLUTTER ANALYSIS/*HELICOPTER PERFORMANCE/*SHAKING
MINS: / AIRCRAFT MODELS/ REAL TIME OPERATION/ RIGID ROTORS/ VIBRATION SIMULATORS
ABA: Author
ABS: The analytical capability of the helicopter stability program is discussed. The parameters which are found to be critical to the air resonance characteristics of the soft in-plane hingeless rotor systems are detailed. A summary of two model test programs, a 1/13.8 Froude-scaled BO-105 model and a 1.67 meter (5.5 foot) diameter Froude-scaled YUH-61A model, are presented with emphasis on the selection of the final parameters which were incorporated in the full scale YUH-61A helicopter. Model test data for this configuration are shown. The actual test results of the YUH-61A air resonance in-flight shake test stability are presented. Included are a concise description of the test setup, which employs the Grumman Automated Telemetry System (ATS), the test technique for recording in-flight stability, and the test procedure used to demonstrate favorable stability characteristics with no in-plane damping augmentation (lag damper removed). The data illustrating the stability trend of air resonance with forward speed and the stability trend of ground resonance for percent airborne are presented.

77N21039*# ISSUE 12 PAGE 1537 CATEGORY 6
76/00/00 16 PAGES UNCLASSIFIED DOCUMENT
UTTL: Inflight Rotor Stability Monitor --- for Sikorsky aircraft
AUTH: A/KUCZYNSKI, W. A.
CORP: Sikorsky Aircraft, Stratford, Conn. AVAIL.NTIS
SAP: HC A21/MF A01
In NASA. Langley Res. Center Flutter Testing Tech. p 457-472 (SEE N77-21022 12-01)
MAJS: /*AERODYNAMIC STABILITY/*IN-FLIGHT MONITORING/*ROTARY STABILITY/*ROTARY WING AIRCRAFT/*SIKORSKY AIRCRAFT
MINS: / FAST FOURIER TRANSFORMATIONS/ FLUTTER ANALYSIS/ MODAL RESPONSE/ REAL TIME OPERATION/ TELEMETRY/ UNIVAC 1110 COMPUTER
ABA: Author
ABS: An inflight rotor stability monitor developed at Sikorsky Aircraft to support stability testing of new rotorcraft is described. The monitor has as its core a damping estimation algorithm which embodies spectral analysis techniques. The interactive system is activated and controlled from a cathode ray tube (CRT) and operates on-line in a flight test telemetry environment. Accurate estimates of the level of damping of critical system modes are generated within one minute of the completion of a prescribed test maneuver. The stability monitor was used successfully to support various Sikorsky research and development flight programs including the UTTAS, CH-53E, S-67 Fan-in-Fin, and ABC.

77N20503*# ISSUE 11 PAGE 1465 CATEGORY 39
CNT#: DAAJ02-75-C-0053 DAAJ02-74-C-0040 76/10/00 27 PAGES UNCLASSIFIED DOCUMENT
UTTL: Thermal and structural analysis of helicopter transmission housings using VASTRAN
AUTH: A/HOWELLS, R. W.; B/SCIARRA, J. J.; C/NG, G. S.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
SAP: HC A24/MF A01
In NASA. Ames Res. Center NASTRAN: User's Experiences p 353-380 (SEE N77-20485 11-39)
MAJS: /*CH-47 HELICOPTER/*NASTRAN/*STRUCTURAL ANALYSIS/*TRANSMISSIONS (MACHINE ELEMENTS)
MINS: / FINITE ELEMENT METHOD/ HELICOPTER DESIGN/ ROTOR BLADES/ THERMAL STRESSES
ABA: Author
ABS: The application of NASTRAN to improve the design of helicopter transmission housings is described. A finite element model of the complete forward rotor transmission housing for the Boeing Vertol CH-47C helicopter was used to study thermal distortion and stress, stress and deflection due to static and dynamic loads, load paths, and design optimization by the control of structural energy distribution. The analytical results are correlated with test data and used to reduce weight and to improve strength, service life, failsafety, and reliability. The techniques presented, although applied herein to helicopter transmissions, are sufficiently general to be applicable to any power transmission system.

77N20500*# ISSUE 11 PAGE 1465 CATEGORY 39
CNT#: NAS1-13801 DAAF03-73-C-0122 76/10/00 22 PAGES UNCLASSIFIED DOCUMENT
UTTL: Development, documentation and correlation of a NASTRAN vibration model of the AH-1G helicopter airframe
AUTH: A/CRONKHITE, J. D.
CORP: Bell Helicopter Co., Fort Worth, Tex. AVAIL.NTIS
SAP: HC A24/MF A01
In NASA. Ames Res. Center NASTRAN: User's Experiences p 273-294 (SEE N77-20485 11-39)
MAJS: /*AIRFRAMES/*NASTRAN/*STRUCTURAL ANALYSIS/*UH-1 HELICOPTER
MINS: / HELICOPTER DESIGN/ STATIC TESTS/ STRUCTURAL VIBRATION/ VIBRATION TESTS

ABA: Author
ABS: NASTRAN was evaluated for vibration analysis of the helicopter airframe. The first effort involved development of a NASTRAN model of the AH-1G helicopter airframe and comprehensive documentation of the model. The next effort was to assess the validity of the NASTRAN model by comparisons with static and vibration tests.

77N19488*# ISSUE 10 PAGE 1323 CATEGORY 39
RPT#: NASA-CR-145119 REPT-699-099-016 CNT#:
NAS1-13801 76/02/00 160 PAGES UNCLASSIFIED
DOCUMENT
UTTL: Correlation of AH-1G airframe test data with a NASTRAN mathematical model
AUTH: A/CRONKHITE, J. D.; B/BERRY, V. L.
CORP: Bell Helicopter Co., Fort Worth, Tex. AVAIL.NTIS
SAP: HC A08/MF A01
MAJS: /*MATHEMATICAL MODELS/*MILITARY HELICOPTERS/*NASTRAN/* STRUCTURAL ANALYSIS
MINS: / AIRFRAMES/ COMPUTER PROGRAMS/ HELICOPTER DESIGN/ VIBRATION TESTS
ABA: Author
ABS: Test data was provided for evaluating a mathematical vibration model of the Bell AH-1G helicopter airframe. The math model was developed and analyzed using the NASTRAN structural analysis computer program. Data from static and dynamic tests were used for comparison with the math model. Static tests of the fuselage and tailboom were conducted to verify the stiffness representation of the NASTRAN model. Dynamic test data were obtained from shake tests of the airframe and were used to evaluate the NASTRAN model for representing the low frequency (below 30 Hz) vibration response of the airframe.

77N19059*# ISSUE 10 PAGE 1263 CATEGORY 5 RPT#:
NASA-CR-145115 CNT#: NAS1-13624 76/12/00 47 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Research requirements for emergency power to permit hover-one-engine-inoperative helicopter operation
AUTH: A/YOST, J. H.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
SAP: HC A03/MF A01
MAJS: /*CH-47 HELICOPTER/*EMERGENCIES/*HELICOPTER PROPELLER DRIVE/*HOVERING STABILITY
MINS: / CIVIL AVIATION/ HELICOPTER ENGINES/ HELICOPTER PERFORMANCE/ TURBINE ENGINES
ABA: Author
ABS: The research and technology demonstration requirements to achieve emergency-power capability for a civil helicopter are documented. The goal for emergency power is the ability to hover with one engine inoperative, transition to minimum-power forward flight, and continue to a safe landing where emergency power may or may not be required. The best method to obtain emergency power is to augment the basic engine power by increasing the engine's speed and turbine-inlet temperature, combined with water-alcohol injection at the engine inlet. Other methods, including turbine boost power and flywheel energy, offer potential for obtaining emergency power for minimum time durations. Costs and schedules are estimated for a research and development program to bring emergency power through a hardware-demonstration test. Interaction of engine emergency-power capability with other helicopter systems is examined.

77N19058*# ISSUE 10 PAGE 1262 CATEGORY 5 RPT#:
NASA-CR-145116 D210-11154-1 CNT#: NAS1-13624
76/12/00 37 PAGES UNCLASSIFIED DOCUMENT
UTTL: Research requirements for the reduction of helicopter vibration
AUTH: A/DOMAN, G. S.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
SAP: HC A03/MF A01
MAJS: /*HELICOPTER PERFORMANCE/*STRUCTURAL VIBRATION/* VIBRATION ISOLATORS
MINS: / AIRCRAFT RELIABILITY/ ROTARY WINGS/ STRUCTURAL DESIGN CRITERIA/ TECHNOLOGY ASSESSMENT
ABA: Author
ABS: All prospective approaches to the reduction of helicopter vibrations were searched to establish insight for the planning of a corrective research program. The state of the art as revealed in the literature is summed up and followed by a discussion of state-of-the-art solutions and of identified technological gaps. It is applicable to all helicopters without regard to size. Extending the historic trend toward lower vibration levels will require the successful application of principles which isolate the fuselage from the rotor systems. Simplicity of the necessary isolation systems should be facilitated by providing other refinements of the dynamic design of the system.

77N18155*# ISSUE 9 PAGE 1134 CATEGORY 7 RPT#:
NASA-CR-145112 CNT#: NAS1-13624 76/12/00 36 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Research requirements for development of regenerative engines for helicopters
AUTH: A/SEMPLE, R. D.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS
SAP: HC A03/MF A01

MAJS: /*ENGINE DESIGN/*FUEL CONSUMPTION/*HELICOPTER ENGINES /*REGENERATIVE FUEL CELLS
MINS: / ENGINE NOISE/ REGENERATION (ENGINEERING)/ WEIGHT REDUCTION
ABA: Author
ABS: The improved specific fuel consumption of the regenerative engine was compared to a simple-cycle turboshaft engine. The performance improvement and fuel saving are obtained at the expense of increased engine weight, development and production costs, and maintenance costs. Costs and schedules are estimated for the elements of the research and development program. Interaction of the regenerative engine with other technology goals for an advanced civil helicopter is examined, including its impact on engine noise, hover and cruise performance, helicopter empty weight, drive-system efficiency and weight, one-engine-inoperative hover capability, and maintenance and reliability.

77N18136*# ISSUE 9 PAGE 1130 CATEGORY 5 RPT#: NASA-CR-145120 CNT#: NAS1-13801 76/00/00 148 PAGES UNCLASSIFIED DOCUMENT
UTTL: Correlation of AH-1G helicopter flight vibration data and tailboom static test data with NASTRAN analytical results
AUTH: A/CRONKHITE, J. D.; B/WILSON, H. E.; C/BERRY, V. L.
CORP: Bell Helicopter Co., Fort Worth, Tex. AVAIL.NTIS SAP: HC A07/MF A01
MAJS: /*HELICOPTER PERFORMANCE/*NASTRAN/*STRUCTURAL ANALYSIS /*STRUCTURAL VIBRATION
MINS: / AIRFRAMES/ STATIC TESTS/ TAIL ASSEMBLIES/ TAIL ROTORS
ABA: Author
ABS: Level flight airframe vibration at main rotor excitation frequencies was calculated. A NASTRAN tailboom analysis was compared with test data for evaluation of methods used to determine effective skin in a semimonocoque sheet-stringer structure. The flight vibration correlation involved comparison of level flight vibration for two helicopter configurations: clean wing, at light gross weight and wing stores at heavy gross weight. In the tailboom correlation, deflections and internal loads were compared using static test data and a NASTRAN analysis. An iterative procedure was used to determine the amount of effective skin of buckled panels under compression load.

77N18130*# ISSUE 9 PAGE 1129 CATEGORY 5 RPT#: NASA-CR-145113 CNT#: NAS1-13624 76/12/00 30 PAGES UNCLASSIFIED DOCUMENT
UTTL: Research requirements to reduce empty weight of helicopters by use of advanced materials
AUTH: A/HOFFSTEDT, D. J.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A03/MF A01
MAJS: /*COMPOSITE MATERIALS/*HELICOPTER DESIGN/*STRUCTURAL DESIGN CRITERIA/*WEIGHT REDUCTION
MINS: / AIRCRAFT DESIGN/ ENERGY CONSUMPTION/ STRUCTURAL WEIGHT/ TECHNOLOGY ASSESSMENT
ABA: Author
ABS: Utilization of the new, lightweight, high-strength, aerospace structural-composite (filament/matrix) materials, when specifically designed into a new aircraft, promises reductions in structural empty weight of 12 percent at recurring costs competive with metals. A program of basic and applied research and demonstration is identified with the objective of advancing the state of the art to the point where civil helicopters are confidently designed, produced, certified, and marketed by 1985. A structural empty-weight reduction of 12 percent was shown to significantly reduce energy consumption in modern high-performance helicopters.

77N17004*# ISSUE 8 PAGE 974 CATEGORY 2 RPT#: NASA-CR-151939 D238-10000-4-VOL-4 CNT#: NAS2-9015 76/09/00 4 VOLS 568 PAGES UNCLASSIFIED DOCUMENT
UTTL: Wind tunnel test on a 1/4.622 Froude scale, hingeless rotor, tilt rotor model, volume 4
AUTH: A/MAGEE, J. P.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A24/MF A01
MAJS: /*RIGID ROTORS/*SCALE MODELS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS
MINS: / AERODYNAMIC CHARACTERISTICS/ CRUISING FLIGHT/ DYNAMIC MODELS/ FROUDE NUMBER/ NASA PROGRAMS/ TABLES (DATA)/*AERODYNAMIC FORCES/*AIRSPEED/*ATTITUDE (INCLINATION)/*ROTOR BLADES (TURBOMACHINERY)/*ROTOR SPEED/*STABILITY DERIVATIVES/*STRESS CONCENTRATION /*THRUST LOADS/*WING FLAPS
ABA: Author
ABS: Experimental cruise flight data files from a wind tunnel test on a 1/4.622 Froude scale hingeless rotor, tilt rotor model are reported.
SUM: Diverse data are presented; variables include parametric force, moment and blade fatigue loads, cruising flight speed, aircraft attitude, rotor control input, wing flap deflection, thrust load, and rotor RPM.

77N17003*# ISSUE 8 PAGE 974 CATEGORY 2 RPT#:
NASA-CR-151938 D238-10000-3-VOL-3 CNT#: NAS2-9015
76/09/00 4 VOLS 769 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind tunnel test on a 1/4.622 Froude scale, hingeless rotor, tilt rotor model, volume 3

AUTH: A/MAGEE, J. P.; B/ALEXANDER, H. R.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A99/MF A01

MAJS: /*RIGID ROTORS/*SCALE MODELS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC CHARACTERISTICS/ DYNAMIC MODELS/ FROUDE NUMBER/ HOVERING/ LOW SPEED/ NASA PROGRAMS/ TABLES (DATA)/**AERODYNAMIC FORCES/**AIRSPEED/**ATTITUDE (INCLINATION)/**ROTOR BLADES (TURBOMACHINERY)/**ROTOR SPEED/**STABILITY DERIVATIVES/**STRESS CONCENTRATION /**THRUST LOADS/**WING FLAPS

ABS: For abstract, see N77-17002.

SUM: Diverse data are presented; variables include parametric force, moment and blade fatigue loads, hovering to low speed flight, aircraft attitude, rotor control input, wing flap deflection, thrust load, and rotor RPM.

77N17002*# ISSUE 8 PAGE 974 CATEGORY 2 RPT#:
NASA-CR-151937 D238-10000-2-VOL-2 CNT#: NAS2-9015
76/09/00 4 VOLS 679 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind tunnel test on a 1/4.622 Froude scale, hingeless rotor, tilt rotor model, volume 2

AUTH: A/MAGEE, J. P.; B/ALEXANDER, H. R.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A99/MF A01

MAJS: /*RIGID ROTORS/*SCALE MODELS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC CHARACTERISTICS/ DYNAMIC MODELS/ FROUDE NUMBER/ HOVERING/ LOW SPEED/ NASA PROGRAMS/ TABLES (DATA)/**AERODYNAMIC FORCES/**AIRSPEED/**ATTITUDE (INCLINATION)/**ROTOR BLADES (TURBOMACHINERY)/**ROTOR SPEED/**STABILITY DERIVATIVES/**STRESS CONCENTRATION /**THRUST LOADS/**WING FLAPS

ABA: Author

ABS: Experimental transition data files from a wind tunnel test on a 1/4.622 Froude scale hingeless rotor, tilt rotor model are reported.

SUM: Diverse data are presented; variables include parametric force, moment and blade fatigue loads, hovering to low speed flight, aircraft attitude, rotor control inputs, wing flap deflection, thrust load, and rotor RPM.

77N17001*# ISSUE 8 PAGE 974 CATEGORY 2 RPT#:
NASA-CR-151936 D238-10000-1-VOL-1 CNT#: NAS2-9015
76/09/00 4 VOLS 779 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wind tunnel test on a 1/4.622 Froude scale, hingeless rotor, tilt rotor model, volume 1

AUTH: A/MAGEE, J. P.; B/ALEXANDER, H. R.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC A99/MF A01

MAJS: /*RIGID ROTORS/*SCALE MODELS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC LOADS/ FROUDE NUMBER/ HOVERING/ LOW SPEED/ MATHEMATICAL MODELS, NASA PROGRAMS/ REGRESSION ANALYSIS/ TABLES (DATA)/**AERODYNAMIC FORCES/** AERODYNAMIC LOADS/**AIRSPEED/**ATTITUDE (INCLINATION) /**FLIGHT CHARACTERISTICS/**ROTOR BLADES (TURBOMACHINERY)/**ROTOR SPEED/**STABILITY DERIVATIVES /**STRESS CONCENTRATION/**THRUST LOADS/**WING FLAPS

ABA: Author

ABS: Wing tunnel test data on a 1/4.622 Froude scale, hingeless rotor, tilt rotor mode are reported for all potential flight conditions through hover and a wide envelope of transitions. A mathematical model was used to describe the rotor system in real time simulation by means of regression analyses. Details of the model, test program and data system are provided together with four data files for hover and transition.

SUM: Diverse data are presented; variables include parametric force, moment and blade fatigue loads, flight range, airspeed, aircraft attitude, rotor control inputs, wing flap deflection, thrust loads and rotor RPM.

77N16990*# ISSUE 6 PAGE 972 CATEGORY 2 RPT#:
NASA-TT-F-17395 REPT-337 CNT#: NASW-2791 77/02/00
42 PAGES UNCLASSIFIED DOCUMENT

UTTL: Transonic rotor aerodynamics: Fundamentals of the theory

AUTH: A/ISAY, W. H.

CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS SAP: HC A03/MF A01
Washington NASA Transl. into ENGLISH of "Transsonische Rotoraerodyn. Grundlagen einer Theorie", Inst. fuer Schiffbau der Hamburg Univ., West Ger., Rept-337, Feb. 1976 33 p

MAJS: /*HELICOPTERS/*ROTARY WINGS/*ROTOR AERODYNAMICS/* TRANSONIC FLOW

MINS: / AERODYNAMIC LOADS/ PRESSURE DISTRIBUTION/ SHOCK WAVE INTERACTION/ THICKNESS/ VISCOSITY

ABA: Author

ABS: A theory is developed in order to calculate the pressure distribution on the blades of a helicopter rotor in forward flight. Neglecting the influence of viscosity the velocity-potential is obtained as well

as the pressure field wave equations with a nonlinear term. Following the theory of wave equations, the influence of accelerated moving shocks on the flow is represented by sink-distributions on the shock surfaces; similarly the loading and thickness-effects of the rotor blades are described by dipoles and source-sink-distributions on the foils.

SUM: No numeric data are presented.

77N12064*# ISSUE 3 PAGE 291 CATEGORY 7 RPT#: NASA-TM-X-74341 AD-A025982 CNT#: NGR-09-010-085
76/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: A new capability for predicting helicopter rotor noise in hover and in flight

AUTH: A/BROWN, T. J.; B/FARASSAT, F.

CORP: Army Air Mobility Research and Development Lab., Hampton, Va. AVAIL.NTIS SAP: HC A02/MF A01

MAJS: /*AIRCRAFT NOISE/*COMPUTER PROGRAMS/*HELICOPTERS/*HOVERING/*ROTARY WINGS

MINS: / ACOUSTIC MEASUREMENT/ BLADE TIPS/ HIGH FREQUENCIES/ SOUND PRESSURE

ABA: GRA

ABS: This paper discusses a new theory and a computer program for realistic calculation of acoustic pressure signature and spectrum of rotor and propeller noise. Many of the common restrictions of already existing theories are removed by using the new theory which is consistent with all previous theories. Only deterministic pressure fluctuations may be used in the program at this stage of development. This will limit the applicability of the program to relatively high tip speeds where it is known that high frequency unsteady pressure fluctuations do not contribute significantly to the sound level. There are very few blade surface pressure measurements and reliable acoustic data available to test the theory in full. Comparison with the measured acoustic data of a high-speed propeller by Hubbard and Lassiter, using limited aerodynamic data in the blade tip region for acoustic calculations, has shown good agreement so far. One important contribution of the new theory is believed to be the removal of the compactness assumption which can introduce errors in acoustic computations. The new capability will be used to study this effect.

77N10044*# ISSUE 1 PAGE 8 CATEGORY 5 RPT#: NASA-CR-2637 R76-911209-47 CNT#: NAS1-10960 DA PROJ. 1F1-61102-AH-45 76/10/00 253 PAGES UNCLASSIFIED DOCUMENT

UTTL: Investigation of a bearingless helicopter rotor concept having a composite primary structure TLSP: Final Report

AUTH: A/BIELAWA, R. L.; B/CHENEY, M. C., JR.; C/NOVAK, R. C.

CORP: United Technologies Research Center East Hartford, Conn. AVAIL.NTIS SAP: HC A12/MF A01

MAJS: /*AEROSPACE/*COMPOSITE STRUCTURES/*FATIGUE (MATERIALS)/*HELICOPTER TAIL ROTORS

MINS: / AEROELASTICITY/ COUPLING/ FEASIBILITY ANALYSIS/ PITCH (INCLINATION)

ABA: Author

ABS: Experimental and analytical investigations were conducted to evaluate a bearingless helicopter rotor concept (CBR) made possible through the use of the specialized nonisotropic properties of composite materials. The investigation was focused on four principal areas which were expected to answer important questions regarding the feasibility of this concept. First, an examination of material properties was made to establish moduli, ultimate strength, and fatigue characteristics of unidirectional graphite/epoxy, the composite material selected for this application. The results confirmed the high bending modulus and strengths and low shear modulus expected of this material, and demonstrated fatigue properties in torsion which make this material ideally suited for the CBR application. Second, a dynamically scaled model was fabricated and tested in the low speed wind tunnel to explore the aeroelastic characteristics of the CBR and to explore various concepts relative to the method of blade pitch control. Two basic control configurations were tested, one in which pitch flap coupling could occur and another which eliminated all coupling. It was found that both systems could be operated successfully at simulated speeds of 180 knots; however, the configuration with coupling present revealed a potential for undesirable aeroelastic response. The uncoupled configuration behaved generally as a conventional hingeless rotor and was stable for all conditions tested.

76N32124*# ISSUE 23 PAGE 2951 CATEGORY 1 RPT#: NASA-CR-2737 SRL-3169-0014 CNT#: NAS1-13705
76/09/00 100 PAGES UNCLASSIFIED DOCUMENT

UTTL: The effect of helicopter main rotor blade phasing and spacing on performance, blade loads, and acoustics TLSP: Final Report

AUTH: A/GANGWANI, S. T.

CORP: Systems Research Labs., Inc., Newport News, Va. AVAIL.NTIS SAP: HC $5.00 Washington NASA

MAJS: /*ACOUSTIC PROPERTIES/*HELICOPTER PERFORMANCE/*ROTOR AERODYNAMICS/*VARIABLE PITCH PROPELLERS

NOISE/ FUSELAGES/ VIBRATORY LOADS

ABA: Author

ABS: The performance, blade loads, and acoustic characteristics of a variable geometry rotor (VGR) system in forward flight and in a pullup maneuver were determined by the use of existing analytical programs. The investigation considered the independent effects of vertical separation of two three-bladed rotor systems as well as the effects of azimuthal spacing between the blades of the two rotors. The computations were done to determine the effects of these parameters on the performance, blade loads, and acoustic characteristics at two advance ratios in steady-state level flight and for two different g pullups at one advance ratio. To evaluate the potential benefits of the VGR concept in forward flight and pullup maneuvers, the results were compared as to performance, oscillatory blade loadings, vibratory forces transmitted to the fixed fuselage, and the rotor noise characteristics of the various VGR configurations with those of the conventional six-bladed rotor system.

76N28958*# ISSUE 19 PAGE 2517 CATEGORY 71
RPT#: NASA-CR-145001 CNT#: NAS1-13690 76/00/00 70 PAGES UNCLASSIFIED DOCUMENT

UTTL: Parametric study of the noise produced by the interaction of the main rotor wake with the tail rotor

AUTH: A/BALCERAK, J. C.

CORP: Systems Research Labs., Inc., Newport News, Va. CSS: (RASA Div.) AVAIL.NTIS SAP: HC $4.50

MAJS: /*HELICOPTER WAKES/*NOISE (SOUND)/*TAIL ROTORS/*WIND TUNNEL TESTS

MINS: / GRAPHS (CHARTS)/ LATERAL STABILITY/ NOISE INTENSITY/ TABLES (DATA)/ VORTICES

ABA: Author

ABS: A model was designed, fabricated and wind tunnel tested to identify some of the parameters which were pertinent to the noise produced by the interaction of the main rotor wake with the tail rotor. The model provided for variations in many geometric and operating parameters. The initial set of tests indicated that the noise produced by the tail rotor was, in general, sensitive to the location of the vortex interaction on the tail rotor disk, direction of rotation, lateral rotor fin spacing, tip speed and the operating mode of the tail rotor; and generally insensitive to main rotor thrust coefficient, longitudinal spacing and tail rotor to main rotor rotational speed ratios. Refinements in the analyses to adequately predict the noise phenomenon have been outlined to complement further experimental investigations.

76N28226*# ISSUE 19 PAGE 2420 CATEGORY 5 RPT# NASA-CR-137655 TR-1273 CNT#: NSG-2045 76/04/00 6. PAGES UNCLASSIFIED DOCUMENT

UTTL: The longitudinal equations of motion of a tilt prop/rotor aircraft including the effects of wing and prop/rotor blade flexibility

AUTH: A/CURTISS, H. C., JR.

CORP: Princeton Univ., N. J. CSS: (Dept. of Aerospace and Mechanical Sciences.) AVAIL.NTIS SAP: HC $4.50

MAJS: /*EQUATIONS OF MOTION/*FLEXIBILITY/*LONGITUDE/*PROPELLER BLADES/*ROTARY WINGS

MINS: / BENDING/ FLEXIBLE WINGS/ HELICOPTERS/ PITCH

ABA: Author

ABS: The equations of motion for the longitudinal dynamics of a tilting prop/rotor aircraft are developed. The analysis represents an extension of the equations of motion. The effects of the longitudinal degrees of freedom of the body (pitch, heave and horizontal velocity) are included. The results of body freedom can be added to the equations of motion for the flexible wing propeller combination.

76N26191*# ISSUE 17 PAGE 2153 CATEGORY 5 RPT#: NASA-CR-149286 SAPR-3 CNT#: NSG-1114 76/06/00 97 PAGES UNCLASSIFIED DOCUMENT

UTTL: Structural dynamics, stability, and control of helicopters TLSP: Semiannual Technical Progress Report, 1 Nov. 1975 - 31 May. 1976

AUTH: A/MEIROVITCH, L.; B/KRAIGE, L. G.; C/HALE, A. L.

CORP: Virginia Polytechnic Inst. and State Univ., Blacksburg. AVAIL.NTIS SAP: HC $5.00

MAJS: /*DYNAMIC STRUCTURAL ANALYSIS/*HELICOPTER DESIGN/*SUBSTRUCTURES/*VIBRATION MODE

MINS: / AERODYNAMIC STABILITY/ AIRFRAMES/ EQUATIONS OF MOTION/ LAGRANGE COORDINATES/ MATHEMATICAL MODELS

ABA: Author

ABS: The dynamic synthesis of a helicopter is reported. The method of approach is a variation of the component mode synthesis in the sense that it regards the aircraft as an assemblage of interconnected substructures. The equations of motion are derived in general form by means of the Lagrangian formulation in conjunction with an orderly kinematical procedure that takes into account the superposition of motion of various substructures, thus circumventing constraint problems.

76N24208*# ISSUE 15 PAGE 1885 CATEGORY 5 RPT#:
NASA-CR-137828 AK-5752-F-1 CNT#: NAS2-8855
76/04/00 132 PAGES UNCLASSIFIED DOCUMENT
UTTL: Evaluation of XV-15 tilt rotor aircraft for flying qualities research application TLSP: Final Report, Jun. - Dec. 1975
AUTH: A/RADFORD, R. C.; B/SCHELHORN, A. E.; C/SIRACUSE, R. J.; D/TILL, R. D.; E/WASSERMAN, R.
CORP: Calspan Corp., Buffalo, N. Y. AVAIL.NTIS SAP: HC $6.00
Sponsored in part by USAAMRDL
MAJS: /*FLIGHT CHARACTERISTICS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM
MINS: / AIRBORNE/SPACEBORNE COMPUTERS/ DISPLAY DEVICES/ FLIGHT CONTROL/ FLIGHT TEST INSTRUMENTS
ABA: Author
ABS: The results of a design review study and evaluation of the XV-15 Tilt Rotor Research Aircraft for flying qualities research application are presented. The objectives of the program were to determine the capability of the XV-15 aircraft and the V/STOLAND system as a safe, inflight facility to provide meaningful research data on flying qualities, flight control systems, and information display systems.

76N23250*# ISSUE 14 PAGE 1758 CATEGORY 5 RPT#:
NASA-CR-144953 D210-11007-1 CNT#: NAS1-13624
75/11/00 267 PAGES UNCLASSIFIED DOCUMENT
UTTL: Identifying and analyzing methods for reducing the energy consumption of helicopters
AUTH: A/DAVIS, S. J.; B/ROSENSTEIN, H. J.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC $9.00
MAJS: /*FUEL CONSUMPTION/*HELICOPTER DESIGN
MINS: / DRAG/ PARAMETERIZATION/ PAYLOADS/ POWER PLANTS/ ROTARY WINGS/ TECHNOLOGY ASSESSMENT
ABA: Author
ABS: The results are presented of a study to identify those helicopter technology areas which would result in the largest energy (or fuel) savings when applied to large tandem (100 passenger) civil helicopters in the 1985 time frame. Baseline aircraft using 1975 technology in the areas of powerplant, rotor efficiency, parasite drag and structure were sized to a very short haul mission of 100 N.M. and a short haul mission of 200 N.M. A systematic parametric analysis was then conducted to assess the impact of technology improvements. Projections of the technology levels that could be obtained in the 1985 time frame were made and the resources estimated to achieve them. Based on these data, the highest payoff (lowest energy) helicopter technologies are identified.

76N23169*# ISSUE 14 PAGE 1747 CATEGORY 2 RPT#:
NASA-CR-147932 76/05/00 125 PAGES UNCLASSIFIED DOCUMENT
UTTL: Computational aspects of real-time simulation of rotary-wing aircraft TLSP: M.S. Thesis
AUTH: A/HOUCK, J. A.
CORP: George Washington Univ., Washington, D.C. AVAIL.NTIS SAP: HC $5.50
Sponsored by NASA
MAJS: /*COMPUTERIZED SIMULATION/*MATHEMATICAL MODELS/*REAL TIME OPERATION/*ROTARY WING AIRCRAFT
MINS: / ROTARY WINGS
ABA: Author
ABS: A study was conducted to determine the effects of degrading a rotating blade element rotor mathematical model suitable for real-time simulation of rotorcraft. Three methods of degradation were studied, reduction of number of blades, reduction of number of blade segments, and increasing the integration interval, which has the corresponding effect of increasing blade azimuthal advance angle. The three degradation methods were studied through static trim comparisons, total rotor force and moment comparisons, single blade force and moment comparisons over one complete revolution, and total vehicle dynamic response comparisons. Recommendations are made concerning model degradation which should serve as a guide for future users of this mathematical model, and in general, they are in order of minimum impact on model validity: (1) reduction of number of blade segments; (2) reduction of number of blades; and (3) increase of integration interval and azimuthal advance angle. Extreme limits are specified beyond which a different rotor mathematical model should be used.

76N20078*# ISSUE 11 PAGE 1338 CATEGORY 2 RPT#:
NASA-TT-F-16846 CNT#: NASW-2791 76/02/00 420 PAGES UNCLASSIFIED DOCUMENT
UTTL: Aircraft use in agriculture and forestry --- spraying with helicopters and light aircraft in the U.S.S.R.
AUTH: A/NAZAROV, V. A.
CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS SAP: HC $11.00
Washington Transl. into ENGLISH of the book ""Primeneniye Aviatsii v Selskom - Lesnom Khozyaystve'' Moscow, Transport, 1975 p 1-311
MAJS: /*AGRICULTURE/*FORESTS/*HELICOPTERS/*LIGHT AIRCRAFT/*SPRAYING/*U.S.S.R.
MINS: / CONSERVATION/ DEFOLIANTS/ FARM CROPS/ FARMLANDS/ FERTILIZERS/ PESTICIDES/ TEXTBOOKS
ABA: Author
ABS: Information is presented (a textbook) on the use of aircraft in agriculture and forestry, agricultural

equipment for airplanes and helicopters, and the technology for performing, organizing, and standardizing aircraft application operations. All forms of aerial agricultural chemical application operations are covered in detail with consideration for the latest data: (1) combatting plant pests and diseases, (2) weed suppression, (3) mineral fertilizer application, (4) crop defoliation, (5) dessication and so on. The latest experience in crew operational procedures and the latest scientific advances are examined. Photographs are included.

76N19146*# ISSUE 10 PAGE 1217 CATEGORY 5 RPT#: NASA-CR-137826 CNT#: NAS2-8799 76/01/00 140 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analytical evaluation of tilting proprotor wind tunnel test requirements TLSP: Technical Report, 1 Apr. - 15 Dec. 1975

AUTH: A/HALL, W. E., JR.; B/BUENZ, D.

CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS SAP: HC $6.00

MAJS: /*ANALYZING/*EVALUATION/*SPECIFICATIONS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS

MINS: / COMPUTER PROGRAMS/ DIGITAL SIMULATION/ RESEARCH AIRCRAFT

ABA: Y.J.A.

ABS: Specific test requirements related to the wind tunnel testing of the XV-15 advanced tilt rotor research aircraft were determined. The following analytical tools were developed: (1) digital simulation of the XV-15, incorporating a simplified tunnel support model, control system loop, measurement lags, gust disturbances, and sensor noise, (2) specialization of existing data analysis programs to the high order XV-15 dynamical model (transfer function program, a time series analysis program, an advanced maximum likelihood parameter identification program), (3) several auxiliary programs to provide estimates of damping from transfer functions as well as calculations of model decomposition of system response. The following results were discussed: (1) modelling of the aircraft, instrumentation, and controls, (2) results of the rotor/cantilever wing model and coupled wing, (3) examples of data prediction with system identification techniques, and (4) detailed conclusions and recommendations.

76N18139*# ISSUE 9 PAGE 1083 CATEGORY 8 RPT#: NASA-CR-137779 VIZEX-CR-74-1A CNT#: NAS2-7307 75/10/00 88 PAGES UNCLASSIFIED DOCUMENT

UTTL: A theoretical study of the application of jet flap circulation control for reduction of rotor vibratory forces, addendum

AUTH: A/RENKA, A. R.

CORP: Vizex, Inc., Amherst, N. Y. AVAIL.NTIS SAP: HC $5.00

Sponsored in part by AMRDL

MAJS: /*HELICOPTERS/*JET FLAPS/*ROTARY WINGS

MINS: / AERODYNAMIC BALANCE/ COMPUTERIZED SIMULATION/ JET CONTROL/ SHEAR FLOW/ VIBRATION

ABA: Author

ABS: The theoretical potential of a jet flap control system for reducing the vertical and horizontal non-cancelling helicopter rotor blade root shears was investigated. It was determined that the dominant contributor to the rotor power requirements is the requirement to maintain moment trim as well as force trim. It was also found that the requirement to maintain moment trim does not entail a power penalty.

76N18123*# ISSUE 9 PAGE 1080 CATEGORY 7 RPT#: NASA-CR-134940 LYC-75-78 CNT#: NAS3-18015 75/10/00 119 PAGES UNCLASSIFIED DOCUMENT

UTTL: Self-acting seals for helicopter engines

AUTH: A/LYNWANDER, P.

CORP: Avco Lycoming Div., Stratford, Conn. AVAIL.NTIS SAP: HC $5.50

MAJS: /*HELICOPTER ENGINES/*SEALS (STOPPERS)

MINS: / GAS TURBINE ENGINES/ SHAFTS (MACHINE ELEMENTS)

ABA: Author

ABS: An experimental evaluation was conducted with NASA-designed self-acting face and circumferential seals for use in the main shaft positions of advanced gas turbine engines. The seals featured Rayleigh step pads (self-acting geometry) for lift augmentation. The tested seals incorporated design improvements over previous self-acting configurations. Self-acting face seals were tested to speeds of 214 m/s (700 ft/sec, 63700 rpm), air pressures of 216.8 N/sq cm abs (314.7 psia), and air temperatures of 688K (778 F). Self-acting circumferential seals were tested to speeds of 183 m/s (600 ft/sec, 47700 rpm), air pressures of 61.8 N/sq cm abs (89.7 psia), and air temperatures of 711 K (820 F). Self-acting face-seals are capable of operating at conditions exceeding conventional seal capability. The limit on speed capability was found to be the flatness of the seal-seat. The self-acting circumferential seal design tested requires further development for use in advanced engines.

76N18107*# ISSUE 9 . PAGE 1078 CATEGORY 5 RPT#:
NASA-CR-137529 REPT-301-099-004 CNT#: NAS2-8084
74/06/01 137 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analysis of the wind tunnel test of a tilt rotor power force model TLSP: Final Report
AUTH: A/MARR, R. L.; B/FORD, D. G.; C/FERGUSON, S. W.
CORP: Bell Helicopter Co., Fort Worth, Tex. AVAIL.NTIS
SAP: HC $6.00
MAJS: /*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS
MINS: / AIRCRAFT PERFORMANCE/ FLIGHT CHARACTERISTICS/ STABILITY DERIVATIVES
ABA: Author
ABS: Two series of wind tunnel tests were made to determine performance, stability and control, and rotor wake interaction on the airframe, using a one-tenth scale powered force model of a tilt rotor aircraft. Testing covered hover (IGE/OGE), helicopter, conversion, and airplane flight configurations. Forces and moments were recorded for the model from predetermined trim attitudes. Control positions were adjusted to trim flight (one-g lift, pitching moment and drag zero) within the uncorrected test data balance accuracy. Pitch and yaw sweeps were made about the trim attitudes with the control held at the trimmed settings to determine the static stability characteristics. Tail on, tail off, rotors on, and rotors off configurations were testes to determine the rotor wake effects on the empennage. Results are presented and discussed.

76N18058*# ISSUE 9 PAGE 1071 CATEGORY 2 RPT#:
NASA-CR-137810 SER-50912 CNT#: NAS2-6463 75/02/27
297 PAGES UNCLASSIFIED DOCUMENT
UTTL: Derivation of equations of motion for multi-blade rotors employing coupled modes and including high twist capability
AUTH: A/SOPHER, R.
CORP: United Aircraft Corp., Stratford, Conn. AVAIL.NTIS
SAP: HC $9.25
MAJS: /*COUPLED MODES/*EQUATIONS OF MOTION/*ROTARY WINGS
MINS: / FLIGHT CHARACTERISTICS/ GUSTS/ HELICOPTERS/ ROTOR AERODYNAMICS
ABA: Author
ABS: The equations of motion are derived for a multiblade rotor. A high twist capability and coupled flatwise-edgewise assumed normal modes are employed instead of uncoupled flatwise - edgewise assumed normal models. The torsion mode is uncoupled. Support system models, consisting of complete helicopters in free flight, or grounded flexible supports, arbitrary rotor-induced inflow, and arbitrary vertical gust models are also used.

76N16773* ISSUE 7 PAGE 894 CATEGORY 53
75/11/00 34 PAGES UNCLASSIFIED DOCUMENT
UTTL: Reaction of passengers to public service vehicle ride
AUTH: A/CLARKE, M. J.; B/OBORNE, D. J.
CORP: University Coll. of Swansea (Wales).
In NASA. Langley Res. Center The 1975 Ride Quality Symp. p 437-470 (SEE N76-16754 07-53)
MAJS: /*COMFORT/*HUMAN REACTIONS/*PASSENGERS
MINS: / GROUND EFFECT MACHINES/ HELICOPTERS/ NOISE INTENSITY / RAIL TRANSPORTATION/ VIBRATION
ABA: Author
ABS: A series of questionnaire studies is described, which was carried out on passengers in public service vehicles in the United Kingdom particularly cross-channel hovercraft, helicopter and train. The effectiveness of the different rating techniques employed is examined and it is demonstrated that useful and reliable information can be obtained on the effects of such physical parameters as vibration, vehicle motion and noise using rating methods which involve no external standards. Some results obtained from analysis of the survey returns are presented.

76N16067*# ISSUE 7 PAGE 802 CATEGORY 5 RPT#:
NASA-TT-F-16869 CNT#: NASA ORDER W-13183 76/02/00
52 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopters on the Baykal-Amur line
AUTH: A/NAZAROV, V. A.
CORP: Joint Publications Research Service, Arlington, Va.
AVAIL.NTIS SAP: HC $4.50
Washington NASA Transl. into ENGLISH from Izd. Transp. (Moscow), 1975 p 1-72
MAJS: /*HELICOPTER DESIGN/*HELICOPTER PERFORMANCE/*U.S.S.R.
MINS: / LAND MANAGEMENT/ MILITARY HELICOPTERS/ MILITARY TECHNOLOGY/ UTILITY AIRCRAFT
ABA: Author
ABS: Flight performance and technical specifications of the Mi-8, Mi-6, Mi-10K, Mi-2, Ka-26, Mi-4 and Mi-1 helicopters are reported in relation to their use in the construction of the Baykal-Amur Line. The book is designed for pilots, technical personnel and construction leaders and workers on the Line.

76N16052*# ISSUE 7 PAGE 800 CATEGORY 3 RPT#:
NASA-CR-146351 CNT#: NSG-1121 76/02/13 75 PAGES
UNCLASSIFIED DOCUMENT
UTTL: The role of the helicopter in transportation --- technology assessment for use in civil aviation
AUTH: A/DAJANI, J. S.; B/WARNER, D.; C/EPSTEIN, D.; D/OBRIEN, J.
CORP: Duke Univ., Durham, N. C. CSS: (Dept. of Civil Engineering.) AVAIL.NTIS SAP: HC $4.50

MAJS: /*CIVIL AVIATION/*HELICOPTERS/*TECHNOLOGY ASSESSMENT
MINS: / AIRLINE OPERATIONS/ AIRPORTS/ ECONOMIC FACTORS/ FEASIBILITY ANALYSIS/ TECHNOLOGICAL FORECASTING
ABA: Author
ABS: A general overview is presented of the role that the helicopter plays in the current aviation scene with special emphasis on its use in the airport access function. Technological problems of present-day aircraft are discussed along with some plausible solutions. The economic and regulatory aspects of commercial helicopter operations are presented. Finally six commercial operations utilizing helicopters are reviewed and conditions that enhance the success of the helicopter in the airport access function are proposed.

76N15063* ISSUE 6 PAGE 666 CATEGORY 5 75/01/00
14 PAGES UNCLASSIFIED DOCUMENT
UTTL: Aerocrane: A hybrid LTA aircraft for aerial crane applications
AUTH: A/PERKINS, R. G., JR.; B/DOOLITTLE, D. B. PAA: B/(All Am. Eng. Co.)
CORP: Naval Air Systems Command, Washington, D. C.
In MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles p 571-584 (SEE N76-15015 06-01)
MAJS: /*AIRSHIPS/*CRANES/*VERTICAL TAKEOFF AIRCRAFT
MINS: / AIRCRAFT DESIGN/ BALLAST (MASS)/ BUOYANCY/ CARGO/ HELICOPTERS/ LIFT/ MATERIALS HANDLING/ PROPELLERS
ABA: Author
ABS: The Aerocrane, a hybrid aircraft, combines rotor lift with buoyant lift to offer VTOL load capability greatly in excess of helicopter technology while eliminating the airship problem of ballast transfer. In addition, the Aerocrane concept sharply reduces the mooring problem of airships and provides 360 deg vectorable thrust to supply a relatively large force component for control of gust loads. Designed for use in short range, ultra heavy lift missions, the Aerocrane operates in a performance envelope unsuitable for either helicopters or airships. Basic design considerations and potential problem areas of the concept are addressed.

76N15055* ISSUE 6 PAGE 665 CATEGORY 5 75/01/00
12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Ultra-heavy vertical lift system: The Heli-Stat --- helicopter - airship combination for materials handling
AUTH: A/PIASECKI, F. N.
CORP: Piasecki Aircraft Corp., Philadelphia, Pa.
In MIT Proc. of the Interagency Workshop on Lighter than Air Vehicles p 465-476 (SEE N76-15015 06-01)

MAJS: /*AIRSHIPS/*HEAVY LIFT HELICOPTERS/*MATERIALS HANDLING
MINS: / CONTROL EQUIPMENT/ COST ESTIMATES/ DESIGN ANALYSIS/ PAYLOADS
ABA: Author
ABS: A hybrid VTOL airship which is combined with helicopters is evaluated. The static lift of the airship supports approximately the full empty weight of the entire assembly. The helicopter rotors furnish the lift to support the payload as well as the propulsion and control about all axes. Thus existing helicopters, with no new technology required, can be made to lift payloads of ten times the capacity of each one alone, and considerably more than that of any airship built so far. A vehicle is described which has a 75-ton payload, based on four existing CH-53D helicopters and an airship of 3,600,000 cu. ft. The method of interconnection is described along with discussion of control, instrumentation, drive system and critical design conditions. The vertical lift and positioning capabilities of this vehicle far exceed any other means available today, yet can be built with a minimum of risk, development cost and time.

76N13041*# ISSUE 4 PAGE 398 CATEGORY 3 RPT#: NASA-CR-2630 M-154 CNT#: NAS8-29584 75/12/00 77 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analysis of atmospheric flow over a surface protrusion using the turbulence kinetic energy equation with reference to aeronautical operating systems TISP: Final Report, Dec. 1973 - Dec. 1974
AUTH: A/FROST, W.; B/HARPER, W. L.
CORP: Tennessee Univ. Space Inst., Tullahoma. AVAIL.NTIS SAP: HC $5.00
Washington NASA
MAJS: /*AIRCRAFT SAFETY/*KINETIC ENERGY/*TURBULENT FLOW/* WIND SHEAR
MINS: / FLIGHT PATHS/ FLIGHT SAFETY/ FLOW DISTRIBUTION/ NUMERICAL ANALYSIS
ABA: Author
ABS: Flow over surface obstructions can produce significantly large wind shears such that adverse flying conditions can occur for aeronautical systems (helicopters, STOL vehicles, etc.). Atmospheric flow fields resulting from a semi-elliptical surface obstruction in an otherwise horizontally homogeneous statistically stationary flow are modelled with the boundary-layer/Boussinesq-approximation of the governing equation of fluid mechanics. The turbulence kinetic energy equation is used to determine the dissipative effects of turbulent shear on the mean flow. Iso-lines of turbulence kinetic energy and turbulence intensity are plotted in the plane of the flow and highlight regions of high turbulence

intensity in the stagnation zone and sharp gradients in intensity along the transition from adverse to favourable pressure gradient. Discussion of the effects of the disturbed wind field in CTOL and STOL aircraft flight path and obstruction clearance standards is given. The results indicate that closer inspection of these presently recommended standards as influenced by wind over irregular terrains is required.

76N11996* ISSUE 3 PAGE 261 CATEGORY 1 75/00/00
10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Short field aircraft --- history of technology development
CORP: Old Dominion Univ., Norfolk, Va.
In its Gen. Aviation and Community Develop. p 17-26 (SEE N76-11994 03-01)
MAJS: /*SHORT TAKEOFF AIRCRAFT/*TECHNOLOGY ASSESSMENT
MINS: / AIRCRAFT CONFIGURATIONS/ AIRCRAFT PERFORMANCE/ HELICOPTERS/ PAYLOADS/ VERTICAL TAKEOFF AIRCRAFT
ABA: F.O.S.
ABS: Short, reduced and vertical takeoff aircraft are discussed in terms of technology development, and the field length performance through the years is reviewed.

76N10005*# ISSUE 1 PAGE 1 CATEGORY 2 RPT#: NASA-CR-137772 CNT#: NAS2-7025 75/10/00 48 PAGES UNCLASSIFIED DOCUMENT
UTTL: Transient airload computer analysis for simulating wind induced impulsive noise conditions of a hovering helicopter rotor
AUTH: A/HALL, G. F.
CORP: United Technologies Research Center, East Hartford, Conn. AVAIL.NTIS SAP: HC $3.75
Sponsored in part by Army Air Mobility R and D Lab., Moffett Field, Calif.
MAJS: /*AIRCRAFT NOISE/*COMPUTER PROGRAMS/*GUST LOADS/* HELICOPTERS/*HOVERING/*ROTARY WINGS
MINS: / BLADE TIPS/ COUPLED MODES/ NUMERICAL ANALYSIS/ PERIODIC VARIATIONS/ VORTICES/ WIND (METEOROLOGY)
ABA: Author
ABS: A numerical analysis was developed to determine the airloads on helicopter rotors operating under near-hovering flight conditions capable of producing impulsive noise. A computer program was written in which the solutions for the rotor tip vortex geometry, inflow, aeroelastic response, and airloads are solved in a coupled manner at sequential time steps, with or without the influence of an imposed steady ambient wind or transient gust. The program was developed for future applications in which predicted airloads would be incorporated in an acoustics analysis to attempt to predict and analyze impulsive noise (blade slap). The analysis was applied to a hovering full-scale rotor for which impulsive noise was recorded in the presence of ambient wind. The predicted tip vortex coordinates are in reasonable agreement with the test data, and the blade airload solutions converged to a periodic behavior for an imposed steady ambient wind conditions.

75N33699* ISSUE 24 PAGE 3085 CATEGORY 54
75/05/00 6 PAGES UNCLASSIFIED DOCUMENT
UTTL: Unique wide field of view visual simulation --- of helicopter flight close to earth surface
AUTH: A/NIEMELA, J.
CORP: Army Avionics Lab., Ft. Monmouth, N. J.
In NASA. Ames Res. Center 11th Ann. Conf. on Manual Control p 377-382 (SEE N75-33675 24-54)
MAJS: /*DISPLAY DEVICES/*FLIGHT SIMULATION/*PILOT PERFORMANCE/*VIDEO EQUIPMENT
MINS: / COMPENSATORY TRACKING/ HELICOPTERS/ HORIZONTAL FLIGHT/ MAN MACHINE SYSTEMS/ MANUAL CONTROL
ABA: Author
ABS: Visual simulations are required to support investigations of the man-machine aspects of helicopter nap-of-the-earth flight. The visual simulation requirements are discussed vis-a-vis available technology. A wide field of view of the world outside the cockpit is necessary to provice adequate visual cues to the pilot. A unique design is described employing three TV monitors, collimating lenses, and electronics to selectively display a wide field of view without the use of a costly wide angle optical probe.

75N33685* ISSUE 24 PAGE 3083 CATEGORY 54 CNT#: NAS1-13653 75/05/00 7 PAGES UNCLASSIFIED DOCUMENT
UTTL: A model for simultaneous monitoring and control --- by pilot during helicopter approaches
AUTH: A/CURRY, R. E.; B/KLEINMAN, D. L.; C/HOFFMAN, W. C.
PAA: B/(Conn. Univ.); C/(Aerospace Systems, Inc.)
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Man-Vehicle Lab.)
In NASA. Ames Res. Center 11th Ann. Conf. on Manual Control p 144-150 (SEE N75-33675 24-54)
MAJS: /*APPROACH CONTROL/*HELICOPTERS/*MATHEMATICAL MODELS/* PILOT PERFORMANCE
MINS: / ADAPTIVE CONTROL/ IN-FLIGHT MONITORING/ INSTRUMENT LANDING SYSTEMS/ MAN MACHINE SYSTEMS
ABA: Author
ABS: Mathematical models of the human operator have been concerned primarily with his input/output

characteristics and his adaptive behavior to sudden changes in the controlled element dynamics. Newer models have examined the ability of the human to detect failures when acting as a monitor. However, models for simultaneous monitoring and control (e.g., an aircraft pilot flying a split axis approach) are necessary for performing pilot task allocations and for coordinated design of display and control subsystems. Flight test results of simulated instrument helicopter approaches conducted have shown the following: (1) constant speed approaches can be made quite comfortably by the pilots; (2) pilots cannot hover on situation displays alone; and (3) pilots can hover with a flight director display, but feel uncomfortable because they do not have enough time to monitor the situation displays.

75N33031*# ISSUE 24 PAGE 2999 CATEGORY 5 RPT#: NASA-CR-132731 SER-50944 CNT#: NAS1-13479 75/06/00 99 PAGES UNCLASSIFIED DOCUMENT

UTTL: Study to investigate design, fabrication and test of low cost concepts for large hybrid composite helicopter fuselage, phase I TLSP: Final Report, Aug. 1974 - Jun. 1975

AUTH: A/ADAMS, K. M.; B/LUCAS, J. J.

CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $4.75

MAJS: /*COMPOSITE MATERIALS/*FUSELAGES/*HELICOPTERS

MINS: / AIRCRAFT DESIGN/ COSTS/ EPOXY RESINS/ GRAPHITE/ PRODUCTION ENGINEERING

ABA: Author

ABS: The development of a frame/stringer/skin fabrication technique for composite airframe construction was studied as a low cost approach to the manufacture of large helicopter airframe components. A center cabin aluminum airframe section of the Sikorsky CH-53D helicopter was selected for evaluation as a composite structure. The design, as developed, is composed of a woven KEVLAR-49/epoxy skin and graphite/epoxy frames and stringers. To support the selection of this specific design concept a materials study was conducted to develop and select a cure compatible graphite and KEVLAR-49/epoxy resin system, and a foam system capable of maintaining shape and integrity under the processing conditions established. The materials selected were, Narmco 5209/Thornel T-300 graphite, Narmco 5209/KEVLAR 49 woven fabric, and Stathane 8747 polyurethane foam. Eight specimens were fabricated, representative of the frame, stringer, and splice joint attachments. Evaluation of the results of analysis and test indicate that design predictions are good to excellent except for some conservatism of the complex frame splice.

75N32112*# ISSUE 23 PAGE 2877 CATEGORY 6 RPT#: NASA-CR-132675 CNT#: NAS1-12876 75/06/00 163 PAGES UNCLASSIFIED DOCUMENT

UTTL: Instrumentation requirements for aircraft parameter identification with application to the helicopter

AUTH: A/SORENSEN, J. A.; B/MOHR, R. L.; C/CLINE, T. B.

CORP: Systems Control, Inc., Palo Alto, Calif. AVAIL.NTIS SAP: HC $6.25

MAJS: /*AIRCRAFT INSTRUMENTS/*HELICOPTERS/*INSTRUMENT ERRORS

MINS: / AIRCRAFT CONTROL/ AIRCRAFT STABILITY/ ERROR ANALYSIS / FLIGHT TESTS/ PARAMETERIZATION

ABA: F.O.S.

ABS: The extent to which instrumentation errors cause degradation in the knowledge of stability and control derivatives identified for flight tests was studied along with the resultant degradation of the flight system performance base on these derivatives. The error in measurement and data processing systems used for parameter identification, error analysis techniques, and the effects of instrumentation, errors on the accuracy of parameter estimates are discussed. The analysis programs were used to study instrumentation error effects on the accuracy of the identified stability and control derivatives of the CH-46 helicopter.

75N32022*# ISSUE 23 PAGE 2865 CATEGORY 2 RPT#: NASA-CR-2573 CNT#: NAS1-12853 75/09/00 56 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analysis of helicopter rotor blade torsional oscillations due to stall TLSP: Final Report

AUTH: A/CRIMI, P.

CORP: Avco Corp., Wilmington, Mass. CSS: (Systems Div.) AVAIL.NTIS SAP: HC $4.25 Washington NASA

MAJS: /*AERODYNAMIC STALLING/*BOUNDARY LAYER SEPARATION/* ROTARY WINGS/*TORSIONAL VIBRATION

MINS: / BOUNDARY LAYER CONTROL/ DYNAMIC RESPONSE/ HELICOPTERS/ VIBRATION

ABA: Author

ABS: An analysis of stall-induced helicopter rotor blade torsional oscillations was carried out, the primary objectives being to predict the onset and severity of the oscillations and their relationship to aircraft and blade parameters. Blade flapping, flapwise bending, and torsional degrees of freedom were taken into account, with radial variation in aerodynamic loading determined from a previously developed dynamic stall model. Results of analyses were compared with data from flight tests of helicopters. Analyses were carried out while parametrically varying blade vibrational characteristics. It was found that the amplitudes of the higher harmonics of torsional

oscillations can be significantly reduced by either reducing the torsional natural frequency or introducing viscous damping in the torsional degree of freedom. A preliminary investigation was conducted to determine the feasibility and practicality of alleviating the stall problem by means of boundary layer control. The results indicate that boundary layer control would be effective in reducing the higher harmonics of torsional oscillations due to stall and that its implementation would not require excessive power or suction rates.

75N31503* ISSUE 22 PAGE 2799 CATEGORY 39 CNT#: DAAJ02-74-C-0040 75/09/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Finite element analysis using NASTRAN applied to helicopter transmission vibration/noise reduction

AUTH: A/HOWELLS, R. W.; B/SCIARRA, J. J.

CORP: Boeing Vertol Co., Philadelphia, Pa.

In NASA. Langley Res. Center NASTRAN: Users' Experiences p 321-340 (SEE N75-31485 22-39)

MAJS: /*COMPUTER PROGRAMS/*FINITE ELEMENT METHOD/*HELICOPTER ENGINES/*NOISE REDUCTION/*STRUCTURAL ANALYSIS

MINS: / CH-47 HELICOPTER/ DYNAMIC RESPONSE/ STRAIN ENERGY METHODS/ VIBRATION ISOLATORS

ABA: Author

ABS: A finite element NASTRAN model of the complete forward rotor transmission housing for the Boeing Vertol CH-47 helicopter was developed and applied to reduce transmission vibration/noise at its source. In addition to a description of the model, a technique for vibration/noise prediction and reduction is outlined. Also included are the dynamic response as predicted by NASTRAN, test data, the use of strain energy methods to optimize the housing for minimum vibration/noise, and determination of design modifications which will be manufactured and tested. The techniques presented are not restricted to helicopters but are applicable to any power transmission system. The transmission housing model developed can be used further to evaluate static and dynamic stresses, thermal distortions, deflections and load paths, fail-safety/vulnerability, and composite materials.

75N30147*# ISSUE 21 PAGE 2619 CATEGORY 5 RPT#: NASA-CR-137600 D210-10858-2 CNT#: NAS2-8048 74/11/00 407 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conceptual design studies of 1985 commercial VTOL transports that utilized rotors. Volume 2

AUTH: A/MAGEE, J. P.; B/CLARK, R.; C/ALEXANDER, H. R.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC $10.50

MAJS: /*HELICOPTER DESIGN/*ROTARY WING AIRCRAFT/*TRANSPORT AIRCRAFT/*VERTICAL TAKEOFF AIRCRAFT

MINS: / COST EFFECTIVENESS/ ENERGY CONSERVATION/ HELICOPTER PERFORMANCE/ NOISE REDUCTION/ TANDEM ROTOR HELICOPTERS

ABA: Author

ABS: Results of conceptual design studies of tilt rotor and tandem helicopter aircraft for a 200 nautical mile commercial short haul transport mission are presented. The trade study data used in selecting the design point aircraft and technology details necessary to support the design conclusions are included.

75N30146*# ISSUE 21 PAGE 2619 CATEGORY 5 RPT#: NASA-CR-137599 D210-10858-1 CNT#: NAS2-8048 74/11/00 459 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conceptual design studies of 1985 commercial VTOL transports that utilized rotors. Volume 1

AUTH: A/MAGEE, J. P.; B/CLARK, R. D.; C/ALEXANDER, H. R.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC $11.50

MAJS: /*HELICOPTER DESIGN/*ROTARY WING AIRCRAFT/*TRANSPORT AIRCRAFT/*VERTICAL TAKEOFF AIRCRAFT

MINS: / COST EFFECTIVENESS/ ENERGY CONSERVATION/ HELICOPTER PERFORMANCE/ NOISE REDUCTION/ TANDEM ROTOR HELICOPTERS

ABA: Author

ABS: Results of conceptual design studies of commercial rotary wing transport aircraft for the 1985 time period are presented. Two aircraft configurations, a tandem helicopter and a tilt rotor, were designed for a 200 nautical mile short haul mission with an upper limit of 100 passengers. In addition to the baseline aircraft two further designs of each configuration are included to assess the impact of external noise design criteria on the aircraft size, weight, and cost.

75N30145*# ISSUE 21 PAGE 2619 CATEGORY 5 RPT#: NASA-CR-137601 D210-10873-1 CNT#: NAS2-8048 74/11/00 256 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conceptual design study of a 1985 commercial STOL tilt rotor transport

AUTH: A/WIDDISON, C. A.; B/MAGEE, J. P.; C/ALEXANDER, H. R.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC $8.50

MAJS: /*HELICOPTER DESIGN/*SHORT TAKEOFF AIRCRAFT/*TILTING ROTORS/*TRANSPORT AIRCRAFT

MINS: / COST EFFECTIVENESS/ ENERGY CONSERVATION/ HELICOPTER PERFORMANCE/ NOISE REDUCTION/ VERTICAL TAKEOFF AIRCRAFT

ABA: Author

ABS: Results of conceptual engineering design studies of a

STOL tilt rotor commercial aircraft for the 1985 time frame are presented. The details of aircraft size, performance, flying qualities, noise, and cost are included. The savings in terms of fuel economy resulting from STOL operations compared with VTOL vehicles are determined.

75N30021* ISSUE 21 PAGE 2602 CATEGORY 5
75/05/00 31 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotorcraft derivative identification from analytical models and flight test data
AUTH: A/MOLUSIS, J. A.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.)
In AGARD Methods for Aircraft State and Parameter Identification 31 p (SEE N75-29997 21-01) Sponsored in part by NASA and USAAMRDL
MAJS: /*FLIGHT TESTS/*ROTARY WING AIRCRAFT/*STABILITY DERIVATIVES
MINS: / AERODYNAMIC COEFFICIENTS/ AIRCRAFT STABILITY/ HELICOPTER PERFORMANCE/ MATHEMATICAL MODELS/ PARAMETERIZATION/ PREDICTION ANALYSIS TECHNIQUES
ABA: Author
ABS: A general procedure is presented for systematic development of rotorcraft models for use in systems identification, which includes fuselage and rotor degrees of freedom (DOF). Formulations for rigid blade flap and lag as well as the normal mode representation of an elastic blade are developed for hingeless and articulated rotor systems. The method of multiblade coordinates is used to obtain linear constant coefficient state variable models of various levels of approximation. Two of the approximate models, a 6 DOF, are identified from a nonlinear articulated helicopter computer simulation. The results demonstrate the accuracy attainable for each model. Advanced results outline the status of rotorcraft modeling and systems identification and indicate areas that require further investigation.

75N29031*# ISSUE 20 PAGE 2474 CATEGORY 2 RPT#: NASA-CR-132686 CNT#: NGL-39-009-172 75/00/00 197 PAGES UNCLASSIFIED DOCUMENT
UTTL: Unsteady vortex lattice techniques applied to wake formation and performance of the statically thrusting propeller
AUTH: A/HALL, G. F.
CORP: Pennsylvania State Univ., University Park.
AVAIL.NTIS SAP: HC $7.00
MAJS: /*AERODYNAMICS/*HELICOPTER WAKES/*VORTICES
MINS: / AERODYNAMIC FORCES/ LIFT DEVICES/ WING LOADING
ABA: Author
ABS: The application is considered of vortex lattice techniques to the problem of describing the aerodynamics and performance of statically thrusting propellers. A numerical lifting surface theory to predict the aerodynamic forces and power is performed. The chordwise and spanwise loading is modelled by bound vortices fixed to a twisted flat plate surface. In order to eliminate any apriori assumptions regarding the wake shape, it is assumed the propeller starts from rest. The wake is generated in time and allowed to deform under its own self-induced velocity field as the motion of the propeller progresses. The bound circulation distribution is then determined with time by applying the flow tangency boundary condition at certain selected control points on the blades. The aerodynamics of the infinite wing and finite wing are also considered. The details of wake formation and roll-up are investigated, particularly the localized induction effect. It is concluded that proper wake roll-up and roll-up rates can be established by considering the details of motion at the instant of start.

75N28043*# ISSUE 19 PAGE 2544 CATEGORY 3 RPT#: NASA-CR-2532 SER-50891 CNT#: NAS2-8079 75/05/00 130 PAGES UNCLASSIFIED DOCUMENT
UTTL: Conceptual design study of 1985 commercial VTOL transports that utilize rotors
AUTH: A/KEFFORD, N. F. K.; B/MUNCH, C. L.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $5.75 Washington NASA
MAJS: /*AIRCRAFT DESIGN/*HELICOPTERS/*TRANSPORT AIRCRAFT/* VERTICAL TAKEOFF AIRCRAFT
MINS: / AIRCRAFT CONFIGURATIONS/ COSTS/ SHORT HAUL AIRCRAFT
ABA: Author
ABS: Conceptual design studies of pure and compound helicopter commercial short-haul transport aircraft for initial fabrication in 1985 were performed to determine their technical and economic feasibility. One-hundred-passenger configurations were optimized for minimum direct operating cost consistent with producibility and marketability, with emphasis on proper account of mass properties, performance and handling qualities adequacy, and suppression of internal and external noise. The effect of external noise constraints was assessed, in terms of gross weight and direct operating cost, for each aircraft.

75N28024*# ISSUE 19 PAGE 2341 CATEGORY 2 RPT#: NASA-CR-137705 CNT#: NAS2-6340 75/05/00 95 PAGES UNCLASSIFIED DOCUMENT

UTTL: Optimum performance and potential flow field of hovering rotors TLSP: Final Report

AUTH: A/WU, J. C.; B/SIGMAN, R. K.

CORP: Georgia Inst. of Tech., Atlanta. AVAIL.NTIS SAP: HC $4.75
Sponsored in part by Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*FLOW DISTRIBUTION/*HOVERING/*LIFTING ROTORS

MINS: / AERODYNAMIC CHARACTERISTICS/ GROUND EFFECT/ OPTIMIZATION/ SLIPSTREAMS/ VORTICES

ABA: Author

ABS: Rotor and propeller performance and induced potential flowfields were studied on the basis of a rotating actuator disk concept, with special emphasis on rotors hovering out of ground effect. A new theory for the optimum performance of rotors hovering OGE is developed and presented. An extended theory for the optimum performance of rotors and propellers in axial motion is also presented. Numerical results are presented for the optimum distributions of blade-bound circulation together with axial inflow and ultimate wake velocities for the hovering rotor over the range of thrust coefficient of interest in rotorcraft applications. Shapes of the stream tubes and of the velocities in the slipstream are obtained, using available methods, for optimum and off-optimum circulation distributions for rotors hovering in and out of ground effect. A number of explicit formulae useful in computing rotor and propeller induced flows are presented for stream functions and velocities due to distributions of circular vortices over axi-symmetric surfaces.

75N23611*# ISSUE 15 PAGE 1769 CATEGORY 9 RPT#: NASA-CR-137684 CNT#: NAS2-7684 74/11/00 89 PAGES UNCLASSIFIED DOCUMENT

UTTL: The development of experimental techniques for the study of helicopter rotor noise TLSP: Final Report, Jun. 1973 - Nov. 1974

AUTH: A/WIDNALL, S. E.; B/HARRIS, W. L.; C/LEE, Y. C. A.; D/DREFS, H. M.

CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Fluid Dynamics Research Lab.) AVAIL.NTIS SAP: HC $4.75
Sponsored in part by Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE POLLUTION/*ROTARY WINGS

MINS: / CALIBRATING/ NOISE REDUCTION/ WIND TUNNELS

ABA: Author

ABS: The features of existing wind tunnels involved in noise studies are discussed. The acoustic characteristics of the MIT low noise open jet wind tunnel are obtained by employing calibration techniques. One technique is to measure the decay of sound pressure with distance in the far field; the other technique is to utilize a speaker, which was calibrated, as a sound source. The sound pressure level versus frequency was obtained in the wind tunnel chamber and compared with the corresponding calibrated values. Fiberglas board-block units were installed on the chamber interior. The free field was increased significantly after this treatment and the chamber cut-off frequency was reduced to 160 Hz from the original designed 250 Hz. The flow field characteristics of the rotor-tunnel configuration were studied by using flow visualization techniques. The influence of open-jet shear layer on the sound transmission was studied by using an Aeolian tone as the sound source. A dynamometer system was designed to measure the steady and low harmonics of the rotor thrust. A theoretical Mach number scaling formula was developed to scale the rotational noise and blade slap noise data of model rotors to full scale helicopter rotors.

75N21267*# ISSUE 13 PAGE 1465 CATEGORY 5 RPT#: NASA-CR-132611 ARDE-J/N-41004 CNT#: NAS1-11594 74/10/00 113 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fabrication and testing of prestressed composite rotor blade spar specimens TLSP: Final Report

AUTH: A/GLEICH, D.

CORP: Arde, Inc., Mahwah, N.J. AVAIL.NTIS SAP: HC $5.25

MAJS: /*COMPOSITE MATERIALS/*FRACTURE STRENGTH/*IMPACT RESISTANCE/*ROTARY WINGS

MINS: / CRACK PROPAGATION/ GLASS FIBERS/ HELICOPTER PROPELLER DRIVE/ IMPACT TESTS/ PRESTRESSING/ STAINLESS STEELS/ TERMINAL BALLISTICS

ABA: Author

ABS: Prestressed composite spar specimens were fabricated and evaluated by crack propagation and ballistic penetration tests. The crack propagation tests on flawed specimens showed that the prestressed composite spar construction significantly suppresses crack growth. Damage from three high velocity 30 caliber projectile hits was confined to three small holes in the ballistic test specimen. No fragmentation or crack propagation was observed indicating good ballistic damage resistance. Rotor attachment approaches and improved structural performance configurations were identified. Design theory was verified by tests. The prestressed composite spar configuration consisted of a compressively prestressed high strength ARDEFORM 301 stainless steel liner overwrapped with pretensioned

S-994 fiberglass.

75N19243*# ISSUE 11 PAGE 1195 CATEGORY 7 RPT#: NASA-CR-134739 LYC-74-55 CNT#: NAS3-16823 74/10/00 72 PAGES UNCLASSIFIED DOCUMENT
UTTL: Development of self-acting seals for helicopter engines
AUTH: A/LYNWANDER, P.
CORP: Avco Lycoming Div., Stratford, Conn. AVAIL.NTIS SAP: HC $4.25
MAJS: /*GAS TURBINE ENGINES/*HELICOPTER ENGINES/*PACKINGS (SEALS)/*PERFORMANCE TESTS
MINS: / EQUIPMENT SPECIFICATIONS/ MATERIALS TESTS/ PRODUCT DEVELOPMENT
ABA: Author
ABS: An experimental evaluation of a NASA-designed self-acting face seal for use in advanced gas turbine main shaft positions was conducted. The seal incorporated Rayleigh step pads (self-acting geometry) for lift augmentation. Satisfactory performance of the gas film seal was demonstrated in a 500-hour endurance test at speeds to 183 m/s (600 ft/sec, 54,000 rpm) and air pressure differential of 137 newtons per square centimeter (198.7 psi). Carbon wear was minor. Tests were also conducted with seal seat runout greater than that expected in engine operation and in a severe sand and dust environment. Seal operation was satisfactory in both these detrimental modes of operation.

75N18220*# ISSUE 10 PAGE 1068 CATEGORY 5 RPT#: NASA-CR-132578 D210-10901-1 CNT#: NAS1-13142 74/11/00 127 PAGES UNCLASSIFIED DOCUMENT
UTTL: Documenting helicopter operations from an energy standpoint
AUTH: A/DAVIS, S. J.; B/STEPNIEWSKI, W. Z.
CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC $5.75
MAJS: /*ENERGY CONSUMPTION/*HELICOPTER PERFORMANCE/*HELICOPTERS
MINS: / AIRCRAFT CONFIGURATIONS/ DATA BASES/ DRAG REDUCTION/ FUEL CONSUMPTION/ PERFORMANCE PREDICTION/ SAFETY MANAGEMENT
ABA: Author
ABS: Results are presented of a study of the relative and absolute energy consumption of helicopters, including limited comparisons with fixed-wing aircraft, and selected surface transportation vehicles. Additional comparisons were made to determine the level of reduction in energy consumption expected from the application of advanced technologies to the helicopter design and sizing process. It was found that improvements in helicopter consumption characteristics can be accomplished through the utilization of advanced technology to reduce drag, structures weight, and powerplant fuel consumption.

75N18178*# ISSUE 10 PAGE 1062 CATEGORY 2 RPT#: NASA-CR-2452 CNT#: NAS1-10856 75/01/00 115 PAGES UNCLASSIFIED DOCUMENT
UTTL: Development of an analysis for the determination of coupled helicopter rotor/control system dynamic response. Part 1: Analysis and applications TLSP: Final Report
AUTH: A/SUTTON, L. R.; B/RINEHART, S. A.
CORP: Rochester Applied Science Associates, Inc., N. Y. AVAIL.NTIS SAP: HC $5.25
Washington NASA
MAJS: /*DYNAMIC RESPONSE/*HELICOPTER CONTROL/*ROTARY WINGS/*ROTOR AERODYNAMICS
MINS: / AERODYNAMIC FORCES/ COMPUTER PROGRAMS/ EQUATIONS OF MOTION/ NUMERICAL ANALYSIS
ABA: Author
ABS: A theoretical analysis is developed for a coupled helicopter rotor system to allow determination of the loads and dynamic response behavior of helicopter rotor systems in both steady-state forward flight and maneuvers. The effects of an anisotropically supported swashplate or gyroscope control system and a deformed free wake on the rotor system dynamic response behavior are included in the analysis.

75N15640*# ISSUE 7 PAGE 732 CATEGORY 5 RPT#: NASA-CR-132546 SER-50905 CNT#: NAS1-11563 75/00/00 173 PAGES UNCLASSIFIED DOCUMENT
UTTL: Flight investigation of rotor/vehicle state feedback
AUTH: A/BRICZINSKI, S. J.; B/COOPER, D. E.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $6.25
Sponsored in part by Army Air Mobility R and D Lab., Hampton, Va.
MAJS: /*FEEDBACK CONTROL/*FLIGHT TESTS/*HELICOPTERS
MINS: / DIGITAL COMPUTERS/ HARMONIC OSCILLATION/ KALMAN FILTERS/ SERVOMECHANISMS/ SIGNAL PROCESSING
ABA: F.O.S.
ABS: The feasibility of using control feedback or rotor tip-path-plane motion or body state as a means of altering rotor and fuselage response in a prescribed manner was investigated to determine the practical limitations of in-flight utilization of a digital computer which conditions and shapes rotor flapping and fuselage state information as feedback signals, before routing these signals to the differential servo actuators. The analysis and test of various feedback schemes are discussed. Test results show that a Kalman

estimator routine which is based on only the first harmonic contributions of blade flapping yields tip-path-plane coefficients which are adequate for use in feedback systems, at speeds up to 150 kts.

75N14726*# ISSUE 6 PAGE 617 CATEGORY 2 RPT#: NASA-CR-2453 CNT#: NAS1-10856 75/01/00 94 PAGES UNCLASSIFIED DOCUMENT

UTTL: Development of an analysis for the determination of coupled helicopter rotor/control system dynamic response. Part 2: Program listing TLSP: Final Report

AUTH: A/SUTTON, L. R.

CORP: Rochester Applied Science Associates, Inc., N. Y. AVAIL.NTIS SAP: HC $4.75 Washington NASA

MAJS: /*DYNAMIC RESPONSE/*HELICOPTER CONTROL/*HELICOPTERS/*ROTORS

MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC LOADS/ GYROSCOPIC STABILITY

ABA: Author

ABS: A theoretical analysis is developed for a coupled helicopter rotor system to allow determination of the loads and dynamic response behavior of helicopter rotor systems in both steady-state forward flight and maneuvers. The effects of an anisotropically supported swashplate or gyroscope control system and a deformed free wake on the rotor system dynamic response behavior are included.

75N12279*# ISSUE 3 PAGE 298 CATEGORY 35 RPT#: NASA-CR-134289 EOD2876 TWP-72-004 CNT#: NAS9-12200 72/08/00 43 PAGES UNCLASSIFIED DOCUMENT

UTTL: Correlation of missions 191, 51M and helicopter photography --- aerial photography and mapping of three areas in Test Site 175 in Texas

AUTH: A/BRYAN, B. A.; B/TUNNEL, S. H.

CORP: Lockheed Electronics Co., Houston, Tex. CSS: (Aerospace Systems Div.) AVAIL.NTIS SAP: HC $3.75

MAJS: /*AERIAL PHOTOGRAPHY/*AERIAL RECONNAISSANCE/*HELICOPTERS/*MAPPING

MINS: / DATA ACQUISITION/ DATA PROCESSING/ LAND USE/ TEXAS

ABA: Author

ABS: The data obtained during aerial photography flights using a helicopter are presented. The areas photographed are identified as three areas within Test Site 175: (1) Rosenberg, (2) Houston Ship Channel/Trinity Bay, and (3) the Somerville Dam. Data are presented in the form of charts. Reproductions of the aerial photographs are included.

75N10106*# ISSUE 1 PAGE 15 CATEGORY 9 RPT#: NASA-CR-132522 REPT-50601 CNT#: NAS1-12841 74/10/00 118 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA-Langley helicopter tower instrumentation systems

AUTH: A/STOFFEL, S. W.

CORP: Wyle Labs., Inc., Hampton, Va. CSS: (Scientific Services and Systems Group.) AVAIL.NTIS SAP: HC $5.25

MAJS: /*HELICOPTER DESIGN/*MEASURING INSTRUMENTS/*TEST FACILITIES/*TOWERS

MINS: / DISPLAY DEVICES/ FREQUENCY RESPONSE/ INSTRUMENT ERRORS/ ROTARY WINGS

ABA: A.A.D.

ABS: Background information is presented for the helicopter rotor test facility, in preface to a more detailed discussion of major subsystems equipment, including error considerations, frequency response, and display instrumentation.

74N34515* ISSUE 24 PAGE 2905 CATEGORY 2 74/00/00 109 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hingeless rotor theory and experiment on vibration reduction by periodic variation of conventional controls

AUTH: A/SISSINGH, G. J.; B/DONHAM, R. E.

CORP: Lockheed-California Co., Burbank. In NASA. Ames Res. Center Rotorcraft Dyn. p 261-277 (SEE N74-34489 24-02)

MAJS: /*FREQUENCY RESPONSE/*HELICOPTER CONTROL/*NUMERICAL ANALYSIS/*RIGID ROTORS/*VIBRATION DAMPING

MINS: / HUBS/ PERIODIC VARIATIONS/ SERVOCONTROL/ TRANSFER FUNCTIONS

ABA: Author

ABS: The reduction of the n per rev. pitch-, roll- and vertical vibrations of an n-bladed rotor by n per rev. sinusoidal variations of the collective and cyclic controls is investigated. The numerical results presented refer to a four-bladed, 7.5-foot model and are based on frequency response tests conducted under an Army-sponsored research program. The following subjects are treated: extraction of the rotor transfer functions (.073R hub flapping and model thrust versus servo valve command, amplitude and phase), calculation of servo commands (volts) required to compensate .073R hub flapping (3P and 5P) and model thrust (4P), evaluation of the effect of the vibratory control inputs on blade loads, and theoretical prediction of the root flapbending moments generated by 0 to 5P perturbations of the feathering angle and rotor angle of attack. Five operating conditions are investigated covering advance ratios from approximately 0.2 to 0.85. The feasibility of vibration reduction by periodic variation on conventional controls is

evaluated.

74N34514* ISSUE 24 PAGE 2904 CATEGORY 2
74/00/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Engine/airframe interface dynamics experience
AUTH: A/FREDRICKSON, C.
CORP: Boeing Vertol Co., Philadelphia, Pa.
In NASA. Ames Res. Center Rotorcraft Dyn. p 249-260 (SEE N74-34489 24-02)
MAJS: /*AIRFRAMES/*HELICOPTER ENGINES/*MECHANICAL DRIVES/*ROTARY WINGS
MINS: / AERODYNAMIC STABILITY/ CRITICAL VELOCITY/ ROTATING SHAFTS/ STRUCTURAL VIBRATION
ABA: Author
ABS: Problems of engine/drive system torsional stability, engine and output shaft critical speeds, and engine vibration at helicopter rotor order frequencies are discussed, and test data and analyses presented. Also presented is a rotor/drive system dynamics problem not directly related to the engine.

74N34513* ISSUE 24 PAGE 2904 CATEGORY 32
74/00/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Identification of structural parameters from helicopter dynamic test data
AUTH: A/GIANSANTE, N.; B/FLANNELLY, W. G.
CORP: Kaman Aircraft Corp., Bloomfield, Conn.
In NASA. Ames Res. Center Rotorcraft Dyn. p 239-248 (SEE N74-34489 24-02)
MAJS: /*DAMPING/*DYNAMIC STRUCTURAL ANALYSIS/*HELICOPTERS/*RESONANT FREQUENCIES
MINS: / COMPUTERIZED SIMULATION/ DYNAMIC RESPONSE/ FUSELAGES / MATHEMATICAL MODELS
ABA: Author
ABS: A method is presented for obtaining the mass, stiffness, and damping parameters of a linear mathematical model, having fewer degrees of freedom than the structure it represents, directly from dynamic response measurements on the actual helicopter without a priori knowledge of the physical characteristics of the fuselage. The only input information required in the formulation is the approximate natural frequency of each mode and mobility data measured proximate to these frequencies with sinusoidal force excitation applied at only one point on the vehicle. The practicality and numerical soundness of the theoretical development was demonstrated through a computer simulation of an experimental program.

74N34509* ISSUE 24 PAGE 2904 CATEGORY 1 CNT#: DA-ARO(D)-1-247-G112 74/00/00 14 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Open and closed loop stability of hingeless rotor helicopter air and ground resonance
AUTH: A/YOUNG, M. I.; B/BAILEY, D. J.; C/HIRSCHBEIN, M. S.
CORP: Delaware Univ., Newark.
In NASA. Ames Res. Center Rotorcraft Dyn. p 205-218 (SEE N74-34489 24-02)
MAJS: /*DAMPING/*FLIGHT STABILITY TESTS/*RESONANCE/*RIGID ROTORS
MINS: / DYNAMIC STABILITY/ FEEDBACK CONTROL/ HELICOPTER PERFORMANCE
ABA: Author
ABS: The air and ground resonance instabilities of hingeless rotor helicopters are examined on a relatively broad parametric basis including the effects of blade tuning, virtual hinge locations, and blade hysteresis damping, as well as size and scale effects in the gross weight range from 5,000 to 48,000 pounds. A special case of a 72,000 pound helicopter air resonance instability is also included. The study shows that nominal to moderate and readily achieved levels of blade inertial hysteresis damping in conjunction with a variety of tuning and/or feedback conditions are highly effective in dealing with these instabilities. Tip weights and reductions in pre-coning angles are also shown to be effective means for improving the air resonance instability.

74N34508* ISSUE 24 PAGE 2904 CATEGORY 2
74/00/00 6 PAGES UNCLASSIFIED DOCUMENT
UTTL: Hub moment springs on two-bladed teetering rotors
AUTH: A/SONNEBORN, W.; B/YEN, J.
CORP: Bell Helicopter Co., Fort Worth, Tex.
In NASA. Ames Res. Center Rotorcraft Dyn. p 199-204 (SEE N74-34489 24-02)
MAJS: /*HELICOPTER PERFORMANCE/*HUBS/*ROTARY WINGS/*TEETERING/*WEIGHTLESSNESS
MINS: / AIRCRAFT STABILITY/ FLIGHT PATHS
ABA: Author
ABS: Two-bladed teetering rotors with elastic flapping hinge restraint are shown to be suitable for zero-g flight. The alternating moment component introduced into the fuselage by the hinge spring can be balanced about the aircraft center of gravity by alternating hub shears. Such shears can be produced in proper magnitude, frequency, and phase by additional underslinging of the hub and by judicious choice of the location of the first inplane cantilevered natural frequency. Trends of theoretical results agree with test results from a small scale model and a modified OH-58A helicopter.

74N34507* ISSUE 24 PAGE 2903 CATEGORY 2
74/00/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Comparison of flight data and analysis for hingeless rotor regressive inplane mode stability

AUTH: A/ANDERSON, W. D.; B/JOHNSTON, J. F.

CORP: Lockheed-California Co., Burbank.

In NASA. Ames Res. Center Rotorcraft Dyn. p 185-197 (SEE N74-34489 24-02)

MAJS: /*AERODYNAMIC STABILITY/*MILITARY HELICOPTERS/*RIGID ROTORS

MINS: / AIRCRAFT CONTROL/ GYROSCOPES/ HELICOPTER PERFORMANCE

ABA: Author

ABS: Analytical and experimental data obtained during the development of the AH-56A covering stability of the regressive inplane mode, including coupling with other modes such as body and rotor plunge are reported. Data were obtained on two distinctly different control systems; both gyro controlled, but one with feathering moment feedback and the other with direct flapping feedback. A review was made of analytical procedures employed in investigating the stability of this mode and a comparison was made of the analytical and experimental data. The effect of certain parameters including blade droop, sweep, delta 3, alpha 1, vehicle roll inertia, inplane frequency, and rpm and forward speed on the mode were also reviewed. It was shown that the stability of this mode is treatable by analysis and that adequate stability is achievable without recourse to auxiliary inplane damping devices.

74N34504* ISSUE 24 PAGE 2903 CATEGORY 2
74/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: An application of Floquet theory to prediction of mechanical instability --- in helicopter rotor blades

AUTH: A/HAMMOND, C. E.

CORP: Army Air Mobility Research and Development Lab., Hampton, Va.

In NASA. Ames Res. Center Rotorcraft Dyn. p 147-158 (SEE N74-34489 24-02)

MAJS: /*FLOQUET THEOREM/*HELICOPTER PERFORMANCE/*MECHANICAL IMPEDANCE/*ROTARY WINGS

MINS: / ANISOTROPY/ EQUATIONS OF MOTION/ HUBS/ MATRICES (MATHEMATICS)/ OSCILLATION DAMPERS/ ROTOR AERODYNAMICS

ABA: Author

ABS: The problem of helicopter mechanical instability is considered for the case where one blade damper is inoperative, and it is shown that if the hub is considered to be nonisotropic, the equations of motion have periodic coefficients which cannot be eliminated. The Floquet transition matrix method is shown to be an effective way of dealing with the nonisotropic hub and nonisotropic rotor situation. Time history calculations are examined and shown to be inferior to the Floquet technique for determining system stability. It is shown that instabilities which occur when one blade damper is inoperative may consist of nearly pure blade motion or they may be similar to the classical mechanical instability.

74N34503* ISSUE 24 PAGE 2903 CATEGORY 2
74/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotor aeroelastic stability coupled with helicopter body motion

AUTH: A/MIAO, W. L.; B/HUBER, H. B. PAA: B/(Messerschmitt-Boelkov-Blohm G.m.b.H., Ottobrunn, West Germany)

CORP: Boeing Vertol Co., Philadelphia, Pa.

In NASA. Ames Res. Center Rotorcraft Dyn. p 137-146 (SEE N74-34489 24-02)

MAJS: /*AERODYNAMIC STABILITY/*AEROELASTICITY/*HELICOPTER CONTROL/*MOTION SIMULATORS/*ROTOR AERODYNAMICS

MINS: / AIRFRAMES/ AIRSPEED/ DAMPING/ GIMBALS/ PITCH (INCLINATION)/ RIGID STRUCTURES/ ROLL/ SCALE MODELS

ABA: Author

ABS: A 5.5-foot-diameter, soft-in-plane, hingeless-rotor system was tested on a gimbal which allowed the helicopter rigid-body pitch and roll motions. Coupled rotor/airframe aeroelastic stability boundaries were explored and the modal damping ratios were measured. The time histories were correlated with analysis with excellent agreement. The effects of forward speed and some rotor design parameters on the coupled rotor/airframe stability were explored both by model and analysis. Some physical insights into the coupled stability phenomenon are suggested.

74N34502* ISSUE 24 PAGE 2903 CATEGORY 2
74/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application to rotary wings of a simplified aerodynamic lifting surface theory for unsteady compressible flow

AUTH: A/RAO, B. M.; B/JONES, W. P.

CORP: Texas A&M Univ., College Station. CSS: (Dept. of Aerospace Engineering.)

In NASA. Ames Res. Center Rotorcraft Dyn. p 127-135 (SEE N74-34489 24-02) Sponsored in part by AROD

MAJS: /*AERODYNAMIC CHARACTERISTICS/*COMPRESSIBLE FLOW/*HELICOPTER CONTROL/*ROTARY WINGS/*ROTOR LIFT

MINS: / AERODYNAMIC COEFFICIENTS/ FLUTTER/ HOVERING/ LOAD DISTRIBUTION (FORCES)/ RIGID ROTORS/ ROTOR AERODYNAMICS

ABA: Author

ABS: A general method of predicting airloads is applied to helicopter rotor blades on a full three-dimensional

basis using the general theory developed for a rotor blade at the psi = pi/2 position where flutter is most likely to occur. Calculations of aerodynamic coefficients for use in flutter analysis are made for forward and hovering flight with low inflow. The results are compared with values given by two-dimensional strip theory for a rigid rotor hinged at its root. The comparisons indicate the inadequacies of strip theory for airload prediction. One important conclusion drawn from this study is that the curved wake has a substantial effect on the chordwise load distribution.

74N34501* ISSUE 24 PAGE 2903 CATEGORY 2 CNT#: DAAJ02-72-C-0093 74/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Control load envelope shaping by live twist
AUTH: A/TARZANIN, F. J., JR.; B/MIRICK, P. H. PAA: B/(Army Air Mobility R and D Lab., Fort Eustis, Va.)
CORP: Boeing Vertol Co., Philadelphia, Pa.
In NASA. Ames Res. Center Rotorcraft Dyn. p 115-125 (SEE N74-34489 24-02)
MAJS: /*AERODYNAMIC LOADS/*HELICOPTER CONTROL/*ROTOR AERODYNAMICS/*TORSIONAL STRESS/*TWISTING
MINS: / AIRSPEED/ ROTATING STALLS/ STIFFNESS
ABA: Author
ABS: Rotor control systems experience a rapid load growth resulting from retreating blade stall during flight conditions of high blade loading or airspeeds. An investigation was undertaken to determine the effect of changing blade torsional properties over the rotor flight envelope. The results of this study show that reducing the blade stiffness to introduce more blade live twist significantly reduces the large retreating blade control loads, while expanding the flight envelope and reducing retreating blade stall loads.

74N34500* ISSUE 24 PAGE 2903 CATEGORY 2 74/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: The effect of cyclic feathering motions on dynamic rotor loads --- for helicopters
AUTH: A/HARVEY, K. W.
CORP: Bell Helicopter Co., Fort Worth, Tex.
In NASA. Ames Res. Center Rotorcraft Dyn. p 107-114 (SEE N74-34489 24-02)
MAJS: /*AERODYNAMIC LOADS/*CYCLIC LOADS/*FEATHERING/*HELICOPTER CONTROL/*ROTOR AERODYNAMICS
MINS: / DEFLECTION/ ELASTIC DEFORMATION/ INERTIA/ NUMERICAL ANALYSIS/ PITCH (INCLINATION)/ ROTARY WINGS
ABA: Author
ABS: The dynamic loads of a helicopter rotor in forward flight are influenced significantly by the geometric pitch angles between the structural axes of the hub and blade sections and the plane of rotation. The analytical study presented includes elastic coupling between inplane and out-of-plane deflections as a function of geometric pitch between the plane of rotation and the principal axes of inertia of each blade. The numerical evaluation is based on a transient analysis using lumped masses and elastic substructure techniques. A comparison of cases with and without cyclic feathering motion shows the effect on computed dynamic rotor loads.

74N34499* ISSUE 24 PAGE 2902 CATEGORY 32 74/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of antiresonance theory to helicopters
AUTH: A/BARTLETT, F. D., JR.; B/FLANNELLY, W. G.
CORP: Kaman Aerospace Corp., Bloomfield, Conn.
In NASA. Ames Res. Center Rotorcraft Dyn. p 101-106 (SEE N74-34489 24-02)
MAJS: /*HELICOPTER CONTROL/*RESONANT VIBRATION
MINS: / ABSORBERS (EQUIPMENT)/ EIGENVALUES/ ITERATION/ MATRICES (MATHEMATICS)/ NODES (STANDING WAVES)/ VIBRATION ISOLATORS
ABA: Author
ABS: Antiresonance theory is the principle underlying nonresonant nodes in a structure, and covers both nonresonant nodes occurring naturally and those introduced by devices such as dynamic absorbers and antiresonant isolators. The dynamic antiresonant vibration isolator (DAVI) and the nodale module are examples of the applications of transfer antiresonances. It is shown that antiresonances are eigenvalues, and that they can be determined by matrix iteration. Applications of antiresonance theory to helicopter engineering problems, using the antiresonant eigenvalue equation are suggested.

74N34498* ISSUE 24 PAGE 2902 CATEGORY 2 74/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter gust response characteristics including unsteady aerodynamic stall effects
AUTH: A/ARCIDIACONO, P. J.; B/BERGQUIST, R. R.; C/ALEXANDER, W. T., JR. PAA: C/(Army Air Mobility R and D Lab., Fort Eustis, Va.)
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.)
In NASA. Ames Res. Center Rotorcraft Dyn. p 91-100 (SEE N74-34489 24-02)
MAJS: /*AERODYNAMIC STALLING/*GUST LOADS/*HELICOPTER PERFORMANCE
MINS: / AIRCRAFT STABILITY/ ATMOSPHERIC TURBULENCE/ FLIGHT CHARACTERISTICS/ ROTOR AERODYNAMICS

ABA: Author
ABS: The results of an analytical study to evaluate the general response characteristics of a helicopter subjected to various types of discrete gust encounters are presented. The analysis employed was a nonlinear coupled, multi-blade rotorfuselage analysis including the effects of blade flexibility and unsteady aerodynamic stall. Only the controls-fixed response of the basic aircraft without any aircraft stability augmentation was considered. A discussion of the basic differences between gust sensitivity of fixed and rotary wing aircraft is presented. The effects of several rotor configuration and aircraft operating parameters on initial gust-induced load factor and blade vibratory stress and pushrod loads are discussed.

74N34497* ISSUE 24 PAGE 2902 CATEGORY 2 CNT#: DAHC04-71-C-0048 74/00/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Coupled rotor/airframe vibration prediction methods
AUTH: A/STALEY, J. A.; B/SCIARRA, J. J.
CORP: Boeing Vertol Co., Philadelphia, Pa.
In NASA. Ames Res. Center Rotorcraft Dyn. p 81-90 (SEE N74-34489 24-02)
MAJS: /*DYNAMIC STRUCTURAL ANALYSIS/*ROTARY WINGS/*VIBRATION TESTS
MINS: / AIRFRAMES/ COMPUTER PROGRAMS/ HELICOPTERS/ ROTORS
ABA: Author
ABS: The problems of airframe structural dynamic representation and effects of coupled rotor/airframe vibration are discussed. Several finite element computer programs (including NASTRAN) and methods for idealization and computation of airframe natural modes and frequencies and forced response are reviewed. Methods for obtaining a simultaneous rotor and fuselage vibratory response, determining effectiveness of vibration control devices, and energy methods for structural optimization are also discussed. Application of these methods is shown for the vibration prediction of the model 347 helicopter.

74N34496* ISSUE 24 PAGE 2902 CATEGORY 32 74/00/00 14 PAGES UNCLASSIFIED DOCUMENT
UTTL: Correlation of finite-element structural dynamic analysis with measured free vibration characteristics for a full-scale helicopter fuselage
AUTH: A/KENIGSBERG, I. J.; B/DEAN, M. W.; C/MALATINO, R.
PAA: C/(Naval Air Systems Command)
CORP: United Aircraft Corp., Stratford, Conn.
In NASA. Ames Res. Center Rotorcraft Dyn. p 67-80 (SEE N74-34489 24-02)

MAJS: /*AIRCRAFT PRODUCTION/*DYNAMIC STRUCTURAL ANALYSIS/* FUSELAGES/*VIBRATION TESTS
MINS: / AIRFRAMES/ DEGREES OF FREEDOM/ HELICOPTERS/ MODAL RESPONSE/ NASA PROGRAMS
ABA: Author
ABS: The correlation achieved with each program provides the material for a discussion of modeling techniques developed for general application to finite-element dynamic analyses of helicopter airframes. Included are the selection of static and dynamic degrees of freedom, cockpit structural modeling, and the extent of flexible-frame modeling in the transmission support region and in the vicinity of large cut-outs. The sensitivity of predicted results to these modeling assumptions are discussed. Both the Sikorsky Finite-Element Airframe Vibration analysis Program (FRAN/Vibration Analysis) and the NASA Structural Analysis Program (NASTRAN) have been correlated with data taken in full-scale vibration tests of a modified CH-53A helicopter.

74N34495* ISSUE 24 PAGE 2902 CATEGORY 2 74/00/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Flap-lag dynamics of hingeless helicopter blades at moderate and high advance ratios
AUTH: A/FRIEDMAN, P.; B/SILVERTHORN, L. J.
CORP: California Univ., Los Angeles. CSS: (Dept. of Mechanics and Structures.)
In NASA. Ames Res. Center Rotorcraft Dyn. p 55-66 (SEE N74-34489 24-02)
MAJS: /*RIGID ROTORS/*ROTOR AERODYNAMICS/*TIME LAG
MINS: / AERODYNAMIC LOADS/ AIRCRAFT STABILITY/ FLAPPING/ FLIGHT TESTS/ HELICOPTERS
ABA: Author
ABS: Equations for large amplitude coupled flaplag motion of a hingeless elastic helicopter blade in forward flight are derived. Only a torsionally rigid blade exicted by quasi-steady aerodynamic loads is considered. The effects of reversed flow together with some new terms due to forward flight are included. Using Galerkin's method the spatial dependence is eliminated and the equations are linearized about a suitable equilibrium position. The resulting system of equations is solved using multivariable Floquet-Liapunov theory, and the transition matrix at the end of the period is evaluated by two separate methods. Results illustrating the effects of forward flight and various important blade parameters on the stability boundaries are presented.

74N34493* ISSUE 24 . PAGE 2902 CATEGORY 2
74/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Dynamic analysis of multi-degree-of-freedom systems using phasing matrices

AUTH: A/BIELAWA, R. L.

CORP: United Aircraft Corp., East Hartford, Conn. CSS: (Research Labs.)
In NASA. Ames Res. Center Rotorcraft Dyn. p 35-43 (SEE N74-34469 24-02)

MAJS: /*DEGREES OF FREEDOM/*DYNAMIC CHARACTERISTICS/* MATRICES (MATHEMATICS)

MINS: / FLUTTER/ HELICOPTERS/ PITCH (INCLINATION)/ ROTOR BLADES/ TORSION

ABA: Author

ABS: A mathematical technique is presented for improved analysis of a wide class of dynamic and aeroelastic systems characterized by several degrees-of-freedom. The technique enables greater utilization of the usual eigensolution obtained from the system dynamic equations by systematizing the identification of destabilizing and/or stiffening forces. Included, as illustrative examples of the use of the technique, are analyses of a helicopter rotor blade for bending-torsion divergence and flutter and for pitch-lag/flap instability.

74N34492* ISSUE 24 PAGE 2902 CATEGORY 2
74/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Computer experiments on periodic systems identification using rotor blade transient flapping-torsion responses at high advance ratio

AUTH: A/HOHENEMSER, K. H.; B/PRELEWICZ, D. A.

CORP: Washington Univ., St. Louis, Mo.
In NASA. Ames Res. Center Rotorcraft Dyn. p 25-34 (SEE N74-34489 24-02)

MAJS: /*FLAPPING HINGES/*ROTOR BLADES/*SYSTEMS STABILITY/* TRANSIENT RESPONSE

MINS: / COMPUTERS/ FLIGHT CONTROL/ ROTARY WING AIRCRAFT/ TORSION

ABA: Author

ABS: Systems identification methods have recently been applied to rotorcraft to estimate stability derivatives from transient flight control response data. While these applications assumed a linear constant coefficient representation of the rotorcraft, the computer experiments described in this paper used transient responses in flap-bending and torsion of a rotor blade at high advance ratio which is a rapidly time varying periodic system.

74N34491* ISSUE 24 PAGE 2901 CATEGORY 2 CNT#: DAAJ02-72-C-0105 74/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Dynamic stall modeling and correlation with experimental data on airfoils and rotors

AUTH: A/CARLSON, R. G.; B/BLACKWELL, R. H.; C/COMMERFORD, G. L.; D/MIRICK, P. H. PAA: D/(Army Air Mobility R and D Lab., Fort Eustis, Va.)

CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.)
In NASA. Ames Res. Center Rotorcraft Dyn. p 13-23 (SEE N74-34489 24-02)

MAJS: /*AERODYNAMIC STALLING/*AIRFOILS/*DATA CORRELATION

MINS: / AIRCRAFT MODELS/ ANGLE OF ATTACK/ HELICOPTER PERFORMANCE/ PITCH (INCLINATION)/ ROTARY WINGS

ABA: Author

ABS: Two methods for modeling dynamic stall have been developed. The alpha, A, B method generates lift and pitching moments as functions of angle of attack and its first two time derivatives. The coefficients are derived from experimental data for oscillating airfoils. The Time Delay Method generates the coefficients from steady state airfoil characteristics and an associated time delay in stall beyond the steady state stall angle. Correlation with three types of test data shows that the alpha, A, B method is somewhat better for use in predicting helicopter rotor response in forward flight. Correlation with lift and moment hysteresis loops generated for oscillating airfoils was good for both models.

74N34483** ISSUE 24 PAGE 2900 CATEGORY 2 RPT#: NASA-CR-137570 CNT#: NAS2-7613 74/06/00 63 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methods studies toward simplified rotor-body dynamics. part 1 TLSP: First Yearly Report

AUTH: A/HOHENEMSER, K. H.; B/YIN, S. K.

CORP: Washington Univ., St. Louis, Mo. CSS: (Dept. of Mechanical and Aerospace Engineering.) AVAIL.NTIS SAP: HC $6.25

MAJS: /*FLIGHT CHARACTERISTICS/*GUST LOADS/*ROTARY WING AIRCRAFT/*ROTOR AERODYNAMICS/*STABILITY DERIVATIVES

MINS: / AERODYNAMIC FORCES/ DYNAMIC RESPONSE/ FLIGHT CONTROL / PITCHING MOMENTS/ TURBULENT FLOW/ TURBULENT WAKES/ YAWING MOMENTS

ABA: Author

ABS: This report is directed to the problem of developing an adequate but not overly complex linear flight dynamics analytical model of a rotorcraft to study stability, control, gust and rancom turbulence responses. Since the conventional flight dynamics analysis using quasisteady rotor derivatives is adequate for the long period modes like the phugoid

mode, only short time responses are considered here, where rotor-body coupling is of importance. Thus the body motion consists of pitch, roll and vertical motion, omitting linear longitudinal and lateral and yaw perturbations. Five analytical models of varying degree of sophistication are applied to a hypothetical hingeless compound helicopter operating up to .8 rotor advance ratio. Stability and response data are obtained for the basic helicopter and for the vehicle with two simple control feedback systems.

74N31948*# ISSUE 21 PAGE 2572 CATEGORY 15
RPT#: NASA-CR-120997 SER-50791 CNT#: NAS3-15684
74/09/10 122 PAGES UNCLASSIFIED DOCUMENT
UTTL: Design guide for helicopter transmission seals
AUTH: A/HAYDEN, T. S.; B/KELLER, C. H., JR.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $9.25
Sponsored in part by Army Air Mobility Research and Development Lab.
MAJS: /*HELICOPTER PROPELLER DRIVE/*PACKINGS (SEALS)/*SHAFTS (MACHINE ELEMENTS)
MINS: / EQUIPMENT SPECIFICATIONS/ MECHANICAL PROPERTIES/ PERFORMANCE TESTS
ABA: Author
ABS: A detailed approach for the selection and design of seals for helicopter transmissions is presented. There are two major types of seals presently being used and they are lip type seals and mechanical type seals. Lip type seals can be divided in conventional lip seals and hydrodynamic lip seals. Conventional lip seals can be used for slow-speed, low-pressure, low-temperature sealing. Hydrodynamic lip seals although they are as pressure and temperature limited as conventional lip seals, can operate at a higher speed. Mechanical types seals are comprised of face seals and circumferential seals. Face seals are capable of high speed, high pressure, and high temperature. Circumferential seals can be used in high-speed and high-temperature applications, but will leak excessively at moderate pressures. The performance goals of transmission seals are a life that is at least equal to the scheduled overhaul interval of the gearbox component and a leakage rate of near zero.

74N31493*# ISSUE 21 PAGE 2513 CATEGORY 2 RPT#: NASA-TT-F-15859 CNT#: NASW-2483 74/08/00 27 PAGES UNCLASSIFIED DOCUMENT
UTTL: Propellers and helicopter blades of fiber-reinforced synthetic resin materials
AUTH: A/HUETTER, U.
CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS SAP: HC $4.50
Washington NASA Presented at 4th European Aerodyn. Congr., Cologne, 18-22 Sep. 1960 Transl. into ENGLISH from Jahrbuch 1960 der. WGL (West Ger.), 1960 p 374-381
MAJS: /*EPOXY RESINS/*HELICOPTERS/*PROPELLERS/*REINFORCED PLASTICS/*ROTARY WINGS
MINS: / COMPOSITE MATERIALS/ GLASS FIBERS/ REINFORCING FIBERS/ STRESS ANALYSIS
ABA: Author
ABS: Shell structures for propellers and helicopter blades are predominantly under centrifugal loads and therefore essentially subjected to such extensive radial stresses that full advantage can be taken of the high tensile strength of strand-reinforced synthetic resin materials. Great difficulties have been encountered in the past with the diffusion of end loads into fiberglass reinforced compound materials. These difficulties, however, can be overcome by applying the loop method, a method by which the diffusion into various strands is accomplished by means of loops formed by continuous layers of strands. By special treatment of the strands before being placed into the mould, any arbitrary distribution of thickness of the shells can be achieved without using special jigs. The application of various manufacturing techniques to the manufacture of aerofoils in large interval flow engines, propellers and helicopter blades is illustrated.

74N28525*# ISSUE 18 PAGE 2125 CATEGORY 2 RPT#: NASA-CR-137515 CNT#: NAS2-7307 74/05/00 143 PAGES UNCLASSIFIED DOCUMENT
UTTL: A theoretical study of the application of jet flap circulation control for reduction of rotor vibratory forces
AUTH: A/PIZIALI, R. A.; B/TRENKA, A. R.
CORP: Vizex, Inc., Amherst, N. Y. AVAIL.NTIS SAP: HC $10.25
MAJS: /*HELICOPTER PERFORMANCE/*HELICOPTERS/*JET FLAPS/*ROTARY WINGS/*ROTOR AERODYNAMICS
MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC LOADS/ COMPUTERIZED SIMULATION/ PERFORMANCE PREDICTION
ABA: Author
ABS: The results of a study to investigate the theoretical potential of a jet-flap control system for reducing the vertical and horizontal non-cancelling helicopter rotor blade root shears are presented. A computer simulation describing the jet-flap control rotor system was developed to examine the reduction of each harmonic of the transmitted shears as a function of various rotor and jet parameters, rotor operating conditions and rotor configurations. The computer

simulation of the air-loads included the influences of nonuniform inflow and blade ealstic motions. (no hub motions were allowed.) The rotor trim and total rotor power (including jet compressor power) were also determined. It was found that all harmonics of the transmitted horizontal and vertical shears could be suppressed simultaneously using a singie jet control.

74N28501*# ISSUE 18 PAGE 2121 CATEGORY 2 RPT#: NASA-TT-F-15704 ONERA-NT-161 CNT#: NASW-2483
74/06/00 65 PAGES UNCLASSIFIED DOCUMENT
Original announced as N71-31813
UTTL: Propeller tests in the large sonic wind tunnel of Mondane-Avrieux
AUTH: A/MASSON, A.
CORP: Scientific Translation Service, Santa Barbara, Calif.; Office National d'Etudes et de Recherches Aerospatiales, Paris (France). AVAIL.NTIS SAP: HC $6.25
Washington NASA Transl. into ENGLISH of ""Essais d'Helices dans la Grande Soufflerie Sonique de Mondane-Avrieux'', ONERA, Paris, report ONERA-NT-161, 1970 35 p
MAJS: /*HELICOPTERS/*PROPELLERS/*ROTARY WINGS/*ROTOR AERODYNAMICS/*TEST FACILITIES/*WIND TUNNEL TESTS
MINS: / AERODYNAMIC CHARACTERISTICS/ DATA ACQUISITION/ PERFORMANCE TESTS
ABA: Author
ABS: The installation for investigations on fullscale or large-scale models of conventional aircraft or convertiplane propellers in a large sonic wind tunnel is described. Some examples of tests carried out and typical results obtained illustrate the use capability of the equipment, which is also suitable for helicopter rotor tests.

74N28229*# ISSUE 17 PAGE 2083 CATEGORY 28
RPT#: NASA-CR-134647 LYC-73-48 CNT#: NAS3-16720
73/11/00 108 PAGES UNCLASSIFIED DOCUMENT
UTTL: Development of helicopter engine seals
AUTH: A/LYNWANDER, P.
CORP: Avco Lycoming Div., Stratford, Conn. AVAIL.NTIS SAP: HC $8.50
Sponsored in part by Army Air Mobility R and D Lab., Cleveland
MAJS: /*AIRCRAFT ENGINES/*ENGINE DESIGN/*HELICOPTERS/*SEALS (STOPPERS)
MINS: / ENGINE PARTS/ GAS TURBINE ENGINES/ SHAFTS (MACHINE ELEMENTS)
ABA: Author
ABS: An experimental evaluation of main shaft seals for helicopter gas turbine engines was conducted with shaft speeds to 213 m/s(700 ft/sec), air pressures to 148 N/sq cm (215 psia), and air temperatures to 645 K (675 F). Gas leakage test results indicate that conventional seals will not be satisfactory for high-pressure sealing because of excessive leakage. The self-acting face seal, however, had significantly lower leakage and operated with insignificant wear during a 150-hour endurance test at sliding speeds to 145 m/s (475 ft/sec), air pressures to 124 N/sq cm (180 psia), and air temperatures to 408 K (275 F). Wear measurements indicate that noncontact operation was achieved at shaft speeds of 43,000 rpm. Evaluation of the self-acting circumferential seal was inconclusive because of seal dimensional variations.

74N27503*# ISSUE 17 PAGE 1991 CATEGORY 2 RPT#: NASA-TT-F-15713 CNT#: NASW-2481 74/07/00 45 PAGES UNCLASSIFIED DOCUMENT
UTTL: On the use of branch modes for the calculation of helicopter structural dynamic characteristics
AUTH: A/TRAN, C. T.; B/TWOMEY, W.; C/DAT, R.
CORP: Kanner (Leo) Associates, Redwood City, Calif. AVAIL.NTIS SAP: HC $5.25
Washington NASA Transl. into ENGLISH from Rech. Aerosp. (France) no. 6, Nov. - Dec. 1973 p 337-354
MAJS: /*AIRFRAMES/*DYNAMIC STRUCTURAL ANALYSIS/*HELICOPTERS
MINS: / APPLICATIONS OF MATHEMATICS/ NUMERICAL ANALYSIS/ STRUCTURAL STABILITY/ VIBRATION EFFECTS
ABA: Author
ABS: The dynamic characteristics of the complete helicopter structure, including fuselage and rotor, are determined from the normal branch modes which characterize separately the fuselage and the blades. With an appropriate choice of coordinates, a set of second order linear differential equations with constant coefficients is obtained. The solutions define natural vibration modes which vary with the blade rotational speed. The results obtained on a helicopter model agree with the experiment.

74N27501*# ISSUE 17 PAGE 1991 CATEGORY 2 RPT#: NASA-CR-137527 DH-2011-C-E1 CNT#: NAS2-3673
73/07/00 92 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analytical study of stresses recorded in the DH 2011 rotor blades TLSP: Final Report
AUTH: A/KRETZ, M.; B/AUBRUN, J. N.; C/LARCHE, M.
CORP: Giravions Dorand Co., Paris (France). AVAIL.NTIS SAP: HC $7.75
Sponsored in part by Army Air Mobility R and D Lab.
MAJS: /*AERODYNAMIC LOADS/*AEROELASTICITY/*HELICOPTERS/*ROTARY WINGS/*ROTOR AERODYNAMICS
MINS: / DATA ACQUISITION/ FLIGHT TESTS/ STRESS ANALYSIS/

VIBRATION MEASUREMENT

ABA: Author

ABS: An analytical study of stresses in the blades recorded during the tests of the DH 2011 jet flap rotor was performed. The main objective of the study was to compare the experimental results with analytical determined stresses. The comparison extended over 15 specific flight cases has been only partially successful. In fact computed 3P and 4P stress components showed only a poor correlation with the test data obtained. It is believed that the simplified model of aeroelastic effects used is mainly responsible for this lack of agreement with test results.

74N26951*# ISSUE 16 PAGE 1919 CATEGORY 14
RPT#: NASA-CR-134305 LEC-TM642-216 TM-63-0257-3213-07
CNT#: NAS9-12200 73/03/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Program CALIB --- for computing noise levels for helicopter version of S-191 filter wheel spectrometer

AUTH: A/MENDLOWITZ, M. A.

CORP: Lockheed Electronics Co., Houston, Tex. AVAIL.NTIS SAP: HC $4.00

MAJS: /*AIRCRAFT NOISE/*COMPUTER PROGRAMS/*HELICOPTERS/* NOISE INTENSITY

MINS: / CALIBRATING/ INPUT/OUTPUT ROUTINES/ PUNCHED CARDS/ SPECTROMETERS/ SUBROUTINES

ABA: F.O.S.

ABS: The program CALIB, which was written to compute noise levels and average signal levels of aperture radiance for the helicopter version of the S-191 filter wheel spectrometer is described. The program functions, and input description are included along with a compiled program listing.

74N25579* ISSUE 15 PAGE 1746 CATEGORY 2
74/04/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter derivative identification from analytic models and flight test data

AUTH: A/MOLUSIS, J. H.; B/BRICZINSKI, S.

CORP: United Aircraft Corp., East Hartford, Conn. CSS: (Sikorsky Aircraft Div.)
In NASA. Flight Res. Center Parameter Estimation Tech. and Appl. in Aircraft Flight Testing p 175-186 (SEE N74-25569 15-02)

MAJS: /*FLIGHT TESTS/*HELICOPTERS/*MATHEMATICAL MODELS/* STABILITY DERIVATIVES

MINS: / DEGREES OF FREEDOM/ KALMAN FILTERS/ LEAST SQUARES METHOD/ ROTARY WINGS

ABA: Author

ABS: Recent results of stability derivative identification from helicopter analytic models and flight test data are presented. Six and nine degree-of-freedom (DOF) linear models are identified from an analytic nonlinear helicopter simulation using a least square technique. The identified models are compared with the convectional partial differentiation method for obtaining derivatives to form the basis for interpretation of derivatives identified from flight data. Six degree-of-freedom models are identified from CH-53A and CH-54B flight data, using an extended Kalman filter modified to process several maneuvers simultaneously. The a priori derivative estimate is obtained by optimal filtering of the data and then using a least square method. The results demonstrate that a six DOF identified model is sufficient to determine the low frequency modes of motion, but a nine DOF rotor/body model is necessary for proper representation of short-term response.

74N25567*# ISSUE 15 PAGE 1744 CATEGORY 2 RPT#: NASA-CR-132430 CNT#: NAS1-12495 74/00/00 87 PAGES UNCLASSIFIED DOCUMENT

UTTL: Community acceptance of helicopter noise: Criteria and application

AUTH: A/MUNCH, C. L.; B/KING, R. J.

CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $7.50

MAJS: /*ACOUSTIC MEASUREMENT/*AERODYNAMIC NOISE/*HELICOPTERS /*NOISE INTENSITY

MINS: / CITIES/ HUMAN REACTIONS/ HUMAN TOLERANCES/ SOUND PROPAGATION

ABA: Author

ABS: A study was conducted to define those criteria necessary for civil helicopter operations to be acoustically acceptable to the communities from which they operate and over which they fly. The study involved surveying existing domestic and foreign Federal regulations and guidelines, state and local noise ordinances, results of community noise annoyance studies, and results of individual aircraft noise annoyance studies, and results of individual aircraft noise annoyance studies in order to establish the criteria. The final criteria selection are based on the Day-Night Level, L sub DN, a measure of total noise exposure. The basic rating unit is the A weighted sound pressure level (dbA) which has accuracy comparable to other units currently used for aircraft. An L sub DN of 60 is recommended as a criterion for areas where the ambient noise is below 58 dbA. An L sub DN value 2 dbA above the local ambient is recommended for areas where the ambient is above 58 dbA.

74N25563*# ISSUE 16 PAGE 1744 CATEGORY 2 RPT#: NASA-CR-132420 D210-10752-2 CNT#: NAS1-12494 74/05/03 99 PAGES UNCLASSIFIED DOCUMENT

UTTL: Civil helicopter noise assessment study Boeing-Vertol model 347 --- recommendations for reduction of helicopter noise levels TLSP: Final Report

AUTH: A/HINTERKEUSER, E. G.; B/STERNFELD, H., JR.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS

SAP: HC $8.00

MAJS: /*AERODYNAMIC NOISE/*HELICOPTERS/*NOISE INTENSITY/* NOISE REDUCTION/*TRANSPORT AIRCRAFT

MINS: / ACOUSTIC MEASUREMENT/ ACOUSTIC PROPERTIES/ FLIGHT PATHS/ HELICOPTER DESIGN

ABA: Author

ABS: A study was conducted to forecast the noise restrictions which may be imposed on civil transport helicopters in the 1975-1985 time period. Certification and community acceptance criteria were predicted. A 50 passenger tandem rotor helicopter based on the Boeing-Vertol Model 347 was studied to determine the noise reductions required, and the means of achieving them. Some of the important study recommendations are: (1) certification limits should be equivalent to 95 EPNdb at data points located at 500 feet to each side of the touchdown/takeoff point, and 1000 feet from this point directly under the approach and departure flight path. (2) community acceptance should be measured as Equivalent Noise Level (Leq), based on dBA, with separate limits for day and night operations, and (3) in order to comply with the above guidelines, the Model 347 helicopter will require studies and tests leading to several modifications.

74N20663*# ISSUE 12 PAGE 1373 CATEGORY 2 RPT#: NASA-CR-114760 HH-74-28 CNT#: NAS2-7254 73/00/00 70 PAGES UNCLASSIFIED DOCUMENT

UTTL: Noise levels of operational helicopters of the OH-6 type designed to meet the LCH mission --- acoustic properties for various helicopter configurations

AUTH: A/WAGNER, R. A.

CORP: Hughes Helicopters, Culver City, Calif. AVAIL.NTIS

SAP: HC $6.50

MAJS: /*ACOUSTIC PROPERTIES/*AERODYNAMIC NOISE/*HELICOPTER PERFORMANCE/*OH-6 HELICOPTER/*ROTOR AERODYNAMICS

MINS: / ACOUSTIC MEASUREMENT/ AERODYNAMIC CONFIGURATIONS/ NOISE INTENSITY/ NOISE PROPAGATION

ABA: Author

ABS: Formulas relating overall sound pressure level (OASPL) to parameters such as horsepower required, tip speed, and thrust for main and tail rotors are presented for standard and quieted helicopters. Formulas relating OASPL to engine parameters such as horsepower output and percent power turbine rpm are presented for unmuffled and muffled engines. The linear scale was used in preference to any of the weighted scales because it resulted in more consistent agreement with the test data when the SPL is expressed in the usual parameters of tip speed, thrust generated and power required. It is recognized that the linear scale does not adequately reflect hearing response, and hence is not a good absolute measure for detection by humans. However, linear OASPL is believed to be useful as a relative means of comparing noise level variations of individual components in similar helicopters with reasonably modest design changes.

74N19666*# ISSUE 11 PAGE 1245 CATEGORY 2 RPT#: NASA-TT-F-806 CNT#: NASW-2465 74/04/00 52 PAGES UNCLASSIFIED DOCUMENT

UTTL: Civil aviation in the USSR (the fiftieth anniversary of its formation)

AUTH: A/AKSENOV, A. F.

CORP: Techtran Corp., Silver Spring, Md. AVAIL.NTIS

SAP: HC $3.75

Washington NASA Transl. into ENGLISH of the Russian book Moscow, Znaniye Press, 1973

MAJS: /*AIR TRAFFIC/*AIR TRANSPORTATION/*CIVIL AVIATION/* HELICOPTERS/*U.S.S.R.

MINS: / AERODYNAMIC CONFIGURATIONS/ AIRCRAFT DESIGN/ AIRCRAFT INDUSTRY/ ECONOMIC FACTORS

ABA: Author

ABS: The history of the development of Soviet civil aviation has paralleled the burgeoning of Soviet power and influence in the 20th century. The influence of aircraft on transportation and national unity is naturally emphasized, while such valuable contributions as the transport of the sick by air, construction of buildings using helicopters, and the aerial surveying and extermination of insect pests are discussed as well. Many types of Soviet aircraft are described and compared as to size, range and other characteristics.

74N18678*# ISSUE 10 PAGE 1121 CATEGORY 2 RPT#: NASA-CR-114749 D210-10666-2 CNT#: NAS2-5473 73/09/15 66 PAGES UNCLASSIFIED DOCUMENT

UTTL: Acoustical properties of a model rotor in nonaxial flight --- wind tunnel model noise measurements TLSP: Final Report

AUTH: A/HINTERKEUSER, E. G.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS

SAP: HC $6.50

Sponsored in part by Army Air Mobility R and D Lab., Moffett Field, Calif.

MAJS: /*ACOUSTIC PROPERTIES/*HORIZONTAL FLIGHT/*HOVERING/* ROTARY WINGS
MINS: / AERODYNAMIC LOADS/ AERODYNAMIC NOISE/ HELICOPTER PROPELLER DRIVE/ PERFORMANCE PREDICTION/ WIND TUNNEL MODELS
ABA: Author
ABS: Wind tunnel measurements on model rotor blade loads and acoustical noise were correlated to a theoretical formulation of the rotational noise of a rotor in non-axial flight. Good correlation between theory and data was achieved using actual measured rotor blade pressure harmonic decay levels and lift, drag and radial force magnitudes. Both pressure and acoustic data exhibited considerable scatter in hover and low speed forward flight which resulted in a fairly wide latitude in the noise level prediction at higher harmonics.

74N18675*# ISSUE 10 PAGE 1121 CATEGORY 2 RPT#: NASA-CR-132372 CNT#: NAS1-11613 73/05/00 216 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analytical study to define a helicoper stability derivative extraction method, volume 2 TLSP: Final Report
AUTH: A/MOLUSIS, J. A.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $14.00
MAJS: /*DEGREES OF FREEDOM/*HELICOPTER CONTROL/*HELICOPTER PERFORMANCE/*STABILITY DERIVATIVES
MINS: / CH-54 HELICOPTER/ DATA ACQUISITION/ DATA PROCESSING/ GRAPHS (CHARTS)/ H-53 HELICOPTER/ KALMAN FILTERS
ABA: P.N.F.
ABS: The data generated during tests to determine helicopter stability derivatives are presented in the form of graphs. The data are based on CH-53A helicopters and CH-54B helicopters with various digital filters operating at various airspeeds. Curves are plotted for a time history comparison of identified derivative models against flight data for the helicopters at specific airspeeds and maneuvers.

74N18674*# ISSUE 10 PAGE 1121 CATEGORY 2 RPT#: NASA-CR-132371 CNT#: NAS1-11613 73/05/00 244 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analytical study to define a helicopter stability derivative extraction method, volume 1 TLSP: Final Report
AUTH: A/MOLUSIS, J. A.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $15.25
MAJS: /*DEGREES OF FREEDOM/*HELICOPTER CONTROL/*HELICOPTER PERFORMANCE/*STABILITY DERIVATIVES
MINS: / CH-54 HELICOPTER/ DATA ACQUISITION/ DATA PROCESSING/ H-53 HELICOPTER/ KALMAN FILTERS/ NUMERICAL ANALYSIS
ABA: Author
ABS: A method is developed for extracting six degree-of-freedom stability and control derivatives from helicopter flight data. Different combinations of filtering and derivative estimate are investigated and used with a Bayesian approach for derivative identification. The combination of filtering and estimate found to yield the most accurate time response match to flight test data is determined and applied to CH-53A and CH-54B flight data. The method found to be most accurate consists of (1) filtering flight test data with a digital filter, followed by an extended Kalman filter (2) identifying a derivative estimate with a least square estimator, and (3) obtaining derivatives with the Bayesian derivative extraction method.

74N18645*# ISSUE 10 PAGE 1117 CATEGORY 1 RPT#: NASA-CR-2275 CNT#: NAS1-10906 74/02/00 114 PAGES UNCLASSIFIED DOCUMENT
UTTL: Experimental investigation of model variable-geometry and ogee tip rotors --- aerodynamic characteristics of variable geometry rotary wings TLSP: Final Report
AUTH: A/LANDGREBE, A. J.; B/BELLINGER, E. D.
CORP: United Aircraft Corp., East Hartford, Conn. CSS: (Research Labs.) AVAIL.NTIS SAP: HC $4.50
Washington NASA
MAJS: /*AERODYNAMIC CONFIGURATIONS/*HELICOPTER PERFORMANCE/* ROTARY WINGS/*ROTOR AERODYNAMICS
MINS: / HELICOPTER WAKES/ TURBULENT FLOW/ VARIABLE GEOMETRY STRUCTURES
ABA: Author
ABS: An experimental investigation was conducted to systematically explore the effects of inter-blade spatial relationships and pitch variations on rotor performance and wake geometry. Variable-geometry rotors consisting of various combinations of blade length, axial spacing, azimuth spacing, and collective pitch were tested at model scale in hover and forward flight. In addition, a hover test of a model rotor with an ogee blade tip design was conducted to determine its performance and wake characteristics. The results of this investigation indicate that properly selected variable geometry rotor configurations can offer substantial improvements in hover performance without adversely affecting forward flight performance. Axial spacing of alternate blades was found to provide the greatest performance benefit, and further improvements were achieved by combining azimuth spacing with axial spacing. The performance benefit appears to be related to the relief of local

adverse aerodynamic phenomena produced by vortex interference. The ogee tip design was found to substantially reduce the concentrated core intensity of the tip vortex, and could thus prove beneficial for the relief of blade-vortex interaction problems. However, the ogee tip was found to reduce hover performance at model scale.

74N15711*# ISSUE 7 PAGE 744 CATEGORY 2 RPT#: NASA-CR-114664 D222-10059-1 CNT#: NAS2-6505 73/10/00 873 PAGES UNCLASSIFIED DOCUMENT

UTTL: V/STOL tilt rotor aircraft study: Wind tunnel tests of a full scale hingeless prop/rotor designed for the Boeing Model 222 tilt rotor aircraft

AUTH: A/MAGEE, J. P.; B/ALEXANDER, H. R.

CORP: Boeing Vertol Co., Philadelphia, Pa. AVAIL.NTIS SAP: HC $45.75

MAJS: /*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*V/STOL AIRCRAFT/*WIND TUNNEL TESTS

MINS: / DYNAMIC RESPONSE/ FEEDBACK CONTROL/ LOAD TESTS/ RIGID ROTORS/ ROTOR AERODYNAMICS/ STABILITY DERIVATIVES

ABA: Author

ABS: The rotor system designed for the Boeing Model 222 tilt rotor aircraft is a soft-in-plane hingeless rotor design, 26 feet in diameter. This rotor has completed two test programs in the NASA Ames 40' X 80' wind tunnel. The first test was a windmilling rotor test on two dynamic wing test stands. The rotor was tested up to an advance ratio equivalence of 400 knots. The second test used the NASA powered propeller test rig and data were obtained in hover, transition and low speed cruise flight. Test data were obtained in the areas of wing-rotor dynamics, rotor loads, stability and control, feedback controls, and performance to meet the test objectives. These data are presented.

74N14758*# ISSUE 6 PAGE 622 CATEGORY 2 RPT#: NASA-CR-114710 CNT#: NAS2-4151 73/06/00 39 PAGES UNCLASSIFIED DOCUMENT

UTTL: Concepts for a theoretical and experimental study of lifting rotor random loads and vibrations (identification of lifting rotor system parameters from transient response data), Phase 7-B

AUTH: A/HOHENEMSER, K. H.; B/PRELEWICZ, D. A.

CORP: Washington Univ., St. Louis, Mo. CSS: (School of Engineering and Applied Science.) AVAIL.NTIS SAP: HC $4.00

MAJS: /*AERODYNAMIC CONFIGURATIONS/*LIFTING ROTORS/*ROTOR AERODYNAMICS/*ROTOR BLADES

MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC FORCES/ DATA ACQUISITION/ FLAPPING

ABA: Author

ABS: System identification methods have been applied to rotorcraft to estimate stability derivatives from transient flight control response data. While these applications assumed a linear constant coefficient representation of the rotorcraft, the computer experiments used transient responses in flap-bending and torsion of a rotor blade at high advance ratio which is a rapidly time varying periodic system. It was found that a simple system identification method applying a linear sequential estimator also called least square estimator or equation of motion estimator, is suitable for this periodic system and can be used directly if only the acceleration data are noise polluted. In the case of noise being present also in the state variable data the direct application of the estimator gave poor results.

74N14757*# ISSUE 6 PAGE 622 CATEGORY 2 RPT#: NASA-CR-114709 CNT#: NAS2-4151 73/06/00 92 PAGES UNCLASSIFIED DOCUMENT

UTTL: Concepts for a theoretical and experimental study of lifting rotor random loads and vibrations (the effects of some rotor feedback systems on rotor-body dynamics), Phase 7-A

AUTH: A/HOHENEMSER, K. H.; B/YIN, S. K.

CORP: Washington Univ., St. Louis, Mo. CSS: (School of Engineering and Applied Science.) AVAIL.NTIS SAP: HC $6.75

MAJS: /*AERODYNAMIC CHARACTERISTICS/*AERODYNAMIC FORCES/* ROTARY WINGS/*ROTOR AERODYNAMICS/*TILTING ROTORS

MINS: / AERODYNAMIC CONFIGURATIONS/ FLIGHT TESTS/ PERFORMANCE TESTS/ ROTOR BLADES

ABA: Author

ABS: The effects of three gyroless rotor feedback systems: (1) coning feedback, (2) proportional tilting feedback, and (3) a combination of these on the rotor-body dynamics of hingeless rotorcraft are studied with a simplified analytical model in the advance ratio range from 0 to .8. Combinations of feedback phase angles and control phase angles are selected to minimize control cross coupling and control sensitivity changes between low and high speed flight. For the feedback systems thus selected the effects of feedback gain and control actuator time lag on the stability both with fixed hub and in free flight is studied, whereby the rotorcraft is free in pitch, roll and vertical motion but otherwise restrained. For the free flight is studied, whereby the rotorcraft is free in pitch, roll and vertical motion but otherwise restrained. For the free flight conditions the effects of a horizontal tail are also determined in itself and in combination with the rotor

feedback systems.

74N14621* ISSUE 5 PAGE 603 CATEGORY 8 73/09/00
18 PAGES UNCLASSIFIED DOCUMENT
UTTL: NASTRAN data generation of helicopter fuselages using interactive graphics --- preprocessor system for finite element analysis using IBM computer
AUTH: A/SAINSBURY-CARTER, J. B.; B/CONAWAY, J. H.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft.)
In NASA. Langley Res. Center NASTRAN: Users' Experiences p 661-678 (SEE N74-14586 05-32)
MAJS: /*AIRFRAMES/*COMPUTER PROGRAMS/*FINITE ELEMENT METHOD/*HELICOPTER DESIGN/*STRUCTURAL ANALYSIS
MINS: / COMPUTER GRAPHICS/ DISPLAY DEVICES/ OPERATING SYSTEMS (COMPUTERS)
ABA: Author
ABS: The development and implementation of a preprocessor system for the finite element analysis of helicopter fuselages is described. The system utilizes interactive graphics for the generation, display, and editing of NASTRAN data for fuselage models. It is operated from an IBM 2250 cathode ray tube (CRT) console driven by an IBM 370/145 computer. Real time interaction plus automatic data generation reduces the nominal 6 to 10 week time for manual generation and checking of data to a few days. The interactive graphics system consists of a series of satellite programs operated from a central NASTRAN Systems Monitor. Fuselage structural models including the outer shell and internal structure may be rapidly generated. All numbering systems are automatically assigned. Hard copy plots of the model labeled with GRID or elements ID's are also available. General purpose programs for displaying and editing NASTRAN data are included in the system. Utilization of the NASTRAN interactive graphics system has made possible the multiple finite element analysis of complex helicopter fuselage structures within design schedules.

74N14616* ISSUE 5 PAGE 602 CATEGORY 32
73/09/00 9 PAGES UNCLASSIFIED DOCUMENT
UTTL: Static and dynamic helicopter airframe analysis with NASTRAN
AUTH: A/WILSON, H. E.; B/CRONKHITE, J. D.
CORP: Bell Helicopter Co., Fort Worth, Tex.
In NASA. Langley Res. Center NASTRAN: Users' Experiences p 611-619 (SEE N74-14586 05-32)
MAJS: /*AIRFRAMES/*COMPUTER PROGRAMS/*DYNAMIC LOADS/*HELICOPTERS/*STATIC LOADS/*STRUCTURAL ANALYSIS/*STRUCTURAL ENGINEERING
MINS: / COMPUTER TECHNIQUES/ HELICOPTER DESIGN/ NUMERICAL ANALYSIS/ STRUCTURAL STABILITY
ABA: Author
ABS: The use of NASTRAN at Bell Helicopter Company for structural static and dynamic analysis of a helicopter airframe is described. Analysis of airframe internal loads, main rotor isolation systems, and airframe vibration is discussed. The use of each rigid format for these types of analysis is summarized. Suggested improvements to NASTRAN to increase its effectiveness in performing helicopter airframe analysis are given.

74N13717*# ISSUE 5 PAGE 485 CATEGORY 2 RPT#: NASA-TT-F-15195 CNT#: NASW-2483 73/12/00 54 PAGES UNCLASSIFIED DOCUMENT
UTTL: New technologies and profitability of helicopters --- application of helicopters to commercial operations
AUTH: A/ANDRES, J.
CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS SAP: HC $4.75
Washington NASA Transl. into ENGLISH of the paper presented at the AGARD Flight Mech. Panel Symp. Aircraft Design Integration and Optimization (Maignane, France), Oct. 1973 22 p
MAJS: /*CIVIL AVIATION/*COMMERCIAL AIRCRAFT/*COST EFFECTIVENESS/*HELICOPTER PERFORMANCE
MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC CONFIGURATIONS/ COST ANALYSIS/ ECONOMICS
ABA: Author
ABS: A study was conducted to determine the economic aspects of helicopter operation for commercial purposes. Concepts of specific cost and cost per kilogram provide the basis for the analysis. The fundamental characteristics of helicopters which determine its mission and profitability are discussed. Specific areas investigated are: (1) fatigue life of components, (2) noise reduction, (3) vibration reduction, (4) optimization of rotary wings, and (5) application of composite materials for helicopter construction.

74N13715*# ISSUE 5 PAGE 485 CATEGORY 2 RPT#: NASA-CR-136504 SUDAAR-459 CNT#: NAS2-5143 73/06/00 88 PAGES UNCLASSIFIED DOCUMENT
UTTL: Automatic control of a helicopter with a hanging load --- development and evaluation of automatic pilot for use with S-61 helicopter
AUTH: A/GUPTA, N. K.; B/BRYSON, A. E., JR.
CORP: Stanford Univ., Calif. CSS: (Guidance and Control Lab.) AVAIL.NTIS SAP: HC $6.50
MAJS: /*AUTOMATIC PILOTS/*HELICOPTER CONTROL/*HELICOPTER PERFORMANCE/*S-61 HELICOPTER

MINS: / EXTERNAL STORES/ FLIGHT CHARACTERISTICS/ LATERAL CONTROL/ LONGITUDINAL CONTROL
ABA: Author
ABS: An autopilot logic is designed here for controlling a helicopter with a hanging load. A 16th order model for the system is decoupled into four subsystems: (1) a second order system for yawing motion, (2) a second order system for vertical motion, (3) a sixth order system for longitudinal motion, and (4) a sixth order system for lateral motion. A measuring scheme, which could be used in remote areas, is developed and filters are designed to estimate the state variables from these measurements. The autopilot can be used to move the load over short distances without retracting the cables. This is done by automatically shifting the autopilot modes from position-hold (hover) to acceleration-hold to velocity-hold (cruise) to deceleration-hold to velocity-hold (near hover) to position-hold (hover). Use of such an autopilot might save considerable turnaround time. The Sikorsky S-61 helicopter is chosen as an example vehicle. The performance of the controlled system is studied in the presence of longitudinal and lateral winds.

74N13709*# ISSUE 5 PAGE 484 CATEGORY 1 RPT#: NASA-CR-136473 AGARD-AG-172 AGARDOGRAPH-172 73/11/00 41 PAGES UNCLASSIFIED DOCUMENT
UTTL: Dynamic stall
AUTH: A/CRIMI, P.; B/YAGGY, P. F. PAA: A/(Avco Corp., Wilmington, Mass.); B/(Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.) PAT: B/ed.
CORP: Advisory Group for Aerospace Research and Development, Paris (France). AVAIL.NTIS SAP: HC $4.25
Sponsored by NASA
MAJS: /*AERODYNAMIC STALLING/*FLOW CHARACTERISTICS/* HELICOPTER PERFORMANCE/*ROTARY WINGS
MINS: / AERODYNAMIC FORCES/ HELICOPTER WAKES/ NUMERICAL ANALYSIS/ TURBULENT FLOW
ABA: Author
ABS: Problems associated with unsteady stall are summarized and past experimental and theoretical studies, relating primarily to dynamic stall of helicopter rotor blades, are reviewed. The problems attendant to analytic treatment of dynamic stall, including identification of relevant flow elements and definition of unsteady separation, are then discussed, and the basis for a theory which accounts for viscous effects and viscous-inviscid interactions analytically is presented. Results of computations are compared with measured loading on an airfoil undergoing sinusoidal pitching motion. The amounts of lift overshoot and their variation with frequency are in good agreement. Analyses of wake-induced stall and stall flutter of a helicopter rotor blade are then presented. The results indicate that the large stall-related torsional oscillations which commonly limit helicopter forward speed are the response to rapid changes in aerodynamic moment which accompany stall and unstall, rather than the consequence of an aeroelastic instability.

74N13708*# ISSUE 5 PAGE 484 CATEGORY 1 RPT#: NASA-CR-2322 CNT#: NAS1-11373 73/11/00 134 PAGES UNCLASSIFIED DOCUMENT
UTTL: Analysis of stall flutter of a helicopter rotor blade TLSP: Final Report
AUTH: A/CRIMI, P.
CORP: Avco Corp., Wilmington, Mass. CSS: (Systems Div.)
AVAIL.NTIS SAP: HC $4.50
Washington NASA Sponsored in part by USAAMRDL
MAJS: /*AERODYNAMIC STALLING/*FLUTTER ANALYSIS/*HELICOPTERS /*HOVERING STABILITY/*ROTARY WINGS
MINS: / AERODYNAMIC CHARACTERISTICS/ AEROELASTICITY/ HELICOPTER PERFORMANCE
ABA: Author
ABS: A study of rotor blade aeroelastic stability was carried out, using an analytic model of a two-dimensional airfoil undergoing dynamic stall and an elastomechanical representation including flapping, flapwise bending and torsional degrees of freedom. Results for a hovering rotor demonstrated that the models used are capable of reproducing both classical and stall flutter. The minimum rotor speed for the occurrence of stall flutter in hover, was found to be determined from coupling between torsion and flapping. Instabilities analogous to both classical and stall flutter were found to occur in forward flight. However, the large stall-related torsional oscillations which commonly limit aircraft forward speed appear to be the response to rapid changes in aerodynamic moment which accompany stall and unstall, rather than the result of an aeroelastic instability. The severity of stall-related instabilities and response was found to depend to some extent on linear stability. Increasing linear stability lessens the susceptibility to stall flutter and reduces the magnitude of the torsional response to stall and unstall.

74N11822*# ISSUE 3 PAGE 243 CATEGORY 1 RPT#: NASA-CR-132355 RASA-73-07 CNT#: NAS1-12012 73/00/00 123 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effect of sweep angle on the pressure distributions and effectiveness of the ogee tip in diffusing a line vortex

AUTH: A/BALCERAK, J. C.; B/FELLER, R. F.
CORP: Rochester Applied Science Associates, Inc., N. Y.
AVAIL.NTIS SAP: HC $8.25
MAJS: /*AERODYNAMIC CHARACTERISTICS/*AERODYNAMIC CONFIGURATIONS/*HELICOPTERS/*ROTARY WINGS/*VORTICES
MINS: / AIR FLOW/ FLOW VISUALIZATION/ HELICOPTER PERFORMANCE / PRESSURE DISTRIBUTION
ABA: Author
ABS: Low-speed wind tunnel tests were conducted to study the influence of sweep angle on the pressure distributions of an ogee-tip configuration with relation to the effectiveness of the ogee tip in diffusing a line vortex. In addition to the pressure data, performance and flow-visualization data were obtained in the wind tunnel tests to evaluate the application of the ogee tip to aircraft configurations. The effect of sweep angle on the performance characteristics of a conventional-tip model, having equivalent planform area, was also investigated for comparison with the ogee-tip configuration. Results of the investigation generally indicate that sweep angle has little effect on the characteristics of the ogee in diffusing a line vortex.

74N11631* ISSUE 2 PAGE 225 CATEGORY 2 73/10/00
17 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter visual aid system
AUTH: A/BAISLEY, R. L.
CORP: Jet Propulsion Lab., California Inst. of Tech., Pasadena.
In NASA. Langley Res. Center The 8th Aerospace Mech. Symp. p 293-309 (SEE N74-11667 02-31)
MAJS: /*FLIGHT TESTS/*HELICOPTERS/*SYSTEMS ENGINEERING/* VISUAL AIDS
MINS: / DISPLAY DEVICES/ IMAGING TECHNIQUES/ OPTICAL EQUIPMENT/ STRUCTURAL DESIGN
ABA: Author
ABS: The helicopter visual aid system has been built and flight tested in situations representative of actual flight missions. The mechanisms discussed contributed greatly to the successful performance of the system throughout the 160 hours of flight testing. It has demonstrated that the visual aid concept can provide improved daytime visual capability, greatly improved nighttime capability, surveillance from greater distances and/or altitudes, covert operation at night through the use of the IR searchlight, and a photographic recording at the scene being viewed.

74N10978*# ISSUE 2 PAGE 129 CATEGORY 5 RPT#: NASA-CR-132347 CNT#: NAS1-11222 73/12/07 89 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effects of helicopter noise and vibration on pilot performance (as measured in a fixed-base flight simulator)
AUTH: A/STAVE, A. M.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $6.50
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*PILOT PERFORMANCE/* VIBRATION EFFECTS
MINS: / COMPUTERIZED SIMULATION/ FLIGHT FATIGUE/ VERTICAL TAKEOFF AIRCRAFT
ABA: Author
ABS: The effects of noise and vibration on pilot performance are described. Pilot subjects were required to fly VTOL commercial IFR schedules using the computer simulation facilities. The routes flown simulated closely metropolitan routes flown currently by a helicopter airline. The duration of simulator flights ranged from 3 to 8 hours. Subjects were exposed to noise sound pressure levels ranging from 74dB (ambient) to 100dB and 17 Hz vibration stimuli ranging from .1 g to .3 g measured at the floor directly beneath the pilot's seat. Despite subject reports of extreme fatigue in these long flights, performance did not degrade. A curve of performance shows a slow improvement for the first three hours of exposure and a slight loss in performance during the remainder of the flight. As environmental stress conditions (noise, vibration, and time in the simulator) increased, subject performance improved. Within the limits of this study, the higher the stress the better the performance.

73N31946*# ISSUE 23 PAGE 2741 CATEGORY 2 RPT#: NASA-CR-114650 D6-60234 CNT#: NAS2-6969 73/07/00
112 PAGES UNCLASSIFIED DOCUMENT
UTTL: Aircraft noise source and computer programs - User's guide
UNOC: Computer programs for predicting the noise-time histories and noise contours for five types of aircraft
AUTH: A/CROWLEY, K. C.; B/JAEGER, M. A.; C/MELDRUM, D. F.
CORP: Boeing Commercial Airplane Co., Seattle, Wash.
AVAIL.NTIS SAP: HC $7.75
MAJS: /*ACOUSTIC MEASUREMENT/*ACOUSTIC PROPERTIES/*AIRCRAFT NOISE/*COMPUTER PROGRAMS
MINS: / ENGINE NOISE/ GAS TURBINES/ HELICOPTERS/ NUMERICAL ANALYSIS/ V/STOL AIRCRAFT
ABA: Author
ABS: The application of computer programs for predicting the noise-time histories and noise contours for five

types of aircraft is reported. The aircraft considered are: (1) turbojet, (2) turbofan, (3) turboprop, (4) V/STOL, and (5) helicopter. Three principle considerations incorporated in the design of the noise prediction program are core effectiveness, limited input, and variable output reporting.

73N31945*# ISSUE 23 PAGE 2741 CATEGORY 2 RPT#: NASA-CR-114649 D6-60233 CNT#: NAS2-6969 73/07/00 233 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aircraft noise source and contour estimation

UNOC: Calculation procedures for predicting noise-time histories and noise contours for various types of aircraft

AUTH: A/DUNN, D. G.; B/PEART, N. A.

CORP: Boeing Commercial Airplane Co., Seattle, Wash. AVAIL.NTIS SAP: HC $13.75

MAJS: /*ACOUSTIC MEASUREMENT/*ACOUSTIC PROPERTIES/*AIRCRAFT NOISE/*NOISE INTENSITY

MINS: / ENGINE NOISE/ HELICOPTERS/ TURBINE ENGINES/ V/STOL AIRCRAFT

ABA: Author

ABS: Calculation procedures are presented for predicting the noise-time histories and noise contours (footprints) of five basic types of aircraft; turbojet, turofan, turboprop, V/STOL, and helicopter. The procedures have been computerized to facilitate prediction of the noise characteristics during takeoffs, flyovers, and/or landing operations.

73N30948*# ISSUE 22 PAGE 2614 CATEGORY 2 RPT#: NASA-CR-112333 CNT#: NAS1-11688 73/06/00 138 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of composites to helicopter airframe and landing gear structures

UNOC: Application of composite materials to construction of helicopter airframes and landing gear TLSP: Technical Report, Jul. 1972 - Feb. 1973

AUTH: A/RICH, M. J.; B/RIDGLEY, G. F.; C/LOWRY, D. W.

CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft.) AVAIL.NTIS SAP: HC $9.00 Sponsored in part by Army Air Mobility R and D Lab., Hampton, Va.

MAJS: /*AIRFRAMES/*COMPOSITE MATERIALS/*COMPOSITE STRUCTURES /*HELICOPTERS/*LANDING GEAR

MINS: / PRODUCTION ENGINEERING/ QUALITY CONTROL/ SERVICE LIFE

ABA: Author

ABS: A preliminary design study has indicated that advanced composite helicopter airframe structures can provide significant system cost advantages in the 1980's. A seven percent increase in productivity and a five percent reduction in life cycle cost are projected. Due to their complexity, landing gear structures do not substantially benefit from the use of advanced composites. The most successful concept was found to be all-molded composite modular panels, which provide integral skin/stringer and frame subassemblies. These subassemblies significantly reduce the number of parts relative to present construction. The subassemblies are mechanically jointed together for economical, rapid final assembly and permit field replacement in the event of major damage.

73N30019*# ISSUE 21 PAGE 2494 CATEGORY 2 RPT#: NASA-TT-F-769 CNT#: NASW-2485 73/08/00 224 PAGES UNCLASSIFIED DOCUMENT

UTTL: Methods and techniques of airframe strength flight tests

UNOC: Analysis of flight test procedures for evaluating strength of airframes for aircraft and helicopters

AUTH: A/GUDKOV, A. I.; B/LESHAKOV, P. S.

CORP: Techtran Corp., Silver Spring, Md. AVAIL.NTIS SAP: HC $5.50 Washington NASA Transl. into ENGLISH of the book ""Metody i Teknnika Letnykh Ispytaniy Samoletov na Prochnost" Moscow, Mashinostr., 1972 p 1-248

MAJS: /*AIRFRAMES/*FLIGHT TESTS/*STRUCTURAL ANALYSIS/* STRUCTURAL STABILITY/*VIBRATION TESTS

MINS: / AIRCRAFT PERFORMANCE/ DATA ACQUISITION/ RELIABILITY ANALYSIS/ SYSTEMS ENGINEERING

ABA: Author

ABS: Methods of flight tests for evaluating the strength of airplanes and helicopters are presented. The basic types of modern measurement equipment used for measuring vibrations, stresses, temperatures and other parameters are described and recommendations are given concerning the preparation and calibration of the equipment. Brief information on laboratory airframe tests is included. Methods of flight tests for strength in which loads and vibrations are measured are discussed. Methods of analyzing measurement data in terms of airframe load features are presented. The basic computer hardware used for processing and analyzing measurement results are described.

73N28981*# ISSUE 20 PAGE 2360 CATEGORY 2 RPT#: NASA-TT-F-15039 CNT#: NASW-2481 73/08/00 34 PAGES UNCLASSIFIED DOCUMENT

UTTL: Computation of unsteady aerodynamic forces on helicopter rotor blades

UNOC: Numerical methods for determining unsteady aerodynamic forces on helicopter rotor blades to show lift distribution as function of velocity component normal

to blades
AUTH: A/COSTES, J. J.
CORP: Kanner (Leo) Associates, Redwood City, Calif.
AVAIL.NTIS SAP: HC $3.75
Washington NASA Transl. into ENGLISH from La Rech. Aerosp. (Paris), no. 2, 1972 p 91-106
MAJS: /*AERODYNAMIC CHARACTERISTICS/*FORCE DISTRIBUTION/* HELICOPTER PERFORMANCE/*LIFT/*ROTARY WINGS
MINS: / AERODYNAMIC FORCES/ APPLICATIONS OF MATHEMATICS/ NUMERICAL ANALYSIS
ABA: Author
ABS: Numerical methods for determining the unsteady aerodynamic forces on helicopter rotor blades are presented. The calculation of the velocity potential induced by a lifting surface element when its position, orientation, and lift are known is developed as a function of time. The collocation method makes it possible to express the lift distribution as a function of the velocity component normal to the blades on a network of collocation points distributed on the rotor disc. A comparison between theory and experiment in the case of forward flight is provided.

73N26481*# ISSUE 17 PAGE 2037 CATEGORY 15
RPT#: NASA-CR-120983 SER-50776 CNT#: NAS3-15684
73/07/00 78 PAGES UNCLASSIFIED DOCUMENT
UTTL: Development of helicopter transmission seals, task 2
UNOC: Design, fabrication, and evaluation of helicopter transmission seals using dual element split ring and circumferential seal configurations
AUTH: A/HAYDEN, T. S.; B/KELLER, C. H., JR.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircarft Div.) AVAIL.NTIS SAP: HC $6.00
Sponsored in part by Army Air Mobility R and D Lab.
MAJS: /*HELICOPTER PROPELLER DRIVE/*PACKINGS (SEALS)
MINS: / EQUIPMENT SPECIFICATIONS/ PERFORMANCE TESTS/ PRODUCT DEVELOPMENT
ABA: Author
ABS: High speed helicopter transmission seal concepts were designed, fabricated and tested. The concepts were a dual element split ring seal and a circumferential seal. The tests were performed in a rig using an actual input quill assembly. The test conditions were selected to simulate transmission operation and were 230 F oil temperature, and a sliding speed of 9400 ft/min. The split ring seal exhibited gross leakage and was considered unsatisfactory, while the circumferential seal leakage was less than 1 c.c./hour; this leakage is within acceptable limits. The circumferential seal wear was only to .0005 inches during a 100 hour run (40 starts and stops). During a 40 hour contamination test (mesh silica flour) the seal total wear was a maximum of .004 inches. This wear is considered acceptable.

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73N25070*# ISSUE 16 PAGE 1661 CATEGORY 2 RPT#: NASA-CR-114626 REPT-300-099-010 CNT#: NAS2-7308
73/05/16 135 PAGES UNCLASSIFIED DOCUMENT
UTTL: Full scale hover test of a 25 foot tilt rotor
UNOC: Full scale hover test of 25-foot tilt rotor
AUTH: A/HELF, S.; B/BROWN, E.; C/GATCHEL, S.; D/CHARLES, B.
CORP: Bell Helicopter Co., Fort Worth, Tex. AVAIL.NTIS
SAP: HC $8.75
MAJS: /*FULL SCALE TESTS/*HOVERING/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*WIND TUNNEL TESTS
MINS: / AERODYNAMICS/ AIRCRAFT NOISE/ PERFORMANCE TESTS
ABA: Author
ABS: The tilt rotor underwent a hover performance test on the Aero Propulsion Laboratory whirl stand at Wright-Patterson Air Force Base. The maximum thrust over density ratio measured at the design tip speed of 740 feet per second was 10,016 pounds. This occurred when the power over density ratio was 1721 horsepower. At the hover overspeed rpm, the thrust and power, over density ratio, were 11,008 pounds and 1866 horsepower. During the test, the maximum measured thrust coefficient was 0.177, and the rotor figure of merit exceeded 0.81. Measured lifting efficiency was 8.35 pounds per horsepower at the thrust a 13,000-pound aircraft would require for hover at sea level on a standard day. No effect of compressibility on performance is discernible in the test results (the range of tip Mach numbers tested was 0.55 to 0.71).

73N24071*# ISSUE 15 PAGE 1735 CATEGORY 2 RPT#: NASA-CR-132053 SUDAAR-446 CNT#: NAS2-5143 72/06/00
31 PAGES UNCLASSIFIED DOCUMENT
UTTL: Synthesis of hover autopilots for rotary-wing VTOL aircraft
UNOC: Synthesis of hover autopilots for rotary wing VTOL aircraft
AUTH: A/HALL, W. E.; B/BRYSON, A. E., JR.
CORP: Stanford Univ., Calif. CSS: (Guidance and Control Lab.) AVAIL.NTIS SAP: HC $3.75
MAJS: /*AUTOMATIC PILOTS/*ROTARY WING AIRCRAFT/*VERTICAL TAKEOFF AIRCRAFT
MINS: / DEGREES OF FREEDOM/ HOVERING/ MATHEMATICAL MODELS/ PITCH (INCLINATION)/ ROTOR AERODYNAMICS/ WIND EFFECTS
ABA: Author
ABS: The practical situation is considered where imperfect information on only a few rotor and fuselage state variables is available. Filters are designed to estimate all the state variables from noisy measurements of fuselage pitch/roll angles and from

noisy measurements of both fuselage and rotor pitch/roll angles. The mean square response of the vehicle to a very gusty, random wind is computed using various filter/controllers and is found to be quite satisfactory although, of course, not so good as when one has perfect information (idealized case). The second part of the report considers precision hover over a point on the ground. A vehicle model without rotor dynamics is used and feedback signals in position and integral of position error are added. The mean square response of the vehicle to a very gusty, random wind is computed, assuming perfect information feedback, and is found to be excellent. The integral error feedback gives zero position error for a steady wind, and smaller position error for a random wind.

73N21053* ISSUE 12 PAGE 1362 CATEGORY 2
73/02/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fundamental Consideration of Noise radiation by rotary wings

UNOC: Analysis of aerodynamic noise produced by rotary wings and methods for noise reduction based on shed vortex wakes and blade tip modification

AUTH: A/LOWSON, M. V.

CORP: Loughborough Univ. of Technology (England).

In AGARD Aerodyn. of Rotary Wings 18 p (SEE N73-21031 12-02) Sponsored by NASA and Natl. Gas Turbine Estab.

MAJS: /*AERODYNAMIC NOISE/*HELICOPTER WAKES/*NOISE REDUCTION /*ROTARY WINGS/*TURBULENT FLOW

MINS: / ACOUSTIC MEASUREMENT/ ACOUSTIC PROPERTIES/ AERODYNAMIC CONFIGURATIONS/ BLADE TIPS

ABA: Author

ABS: An historical review of progress in understanding of rotor noise is presented. Initial work was principally on propellers, but has many obvious applications to noise from rotary wings. Current understanding of rotor noise radiation is then reviewed in some detail. The principal noise sources appear to be: (1) discrete frequency due to distorted inflow; (2) low frequency broadband due to turbulent inflow, and (3) high frequency broadband due to tip effects. On a helicopter rotor each of these sources seems to be intimately connected with the shed vortex wakes. Tip modifications offer one method for controlling the effects. The implications for the designer are discussed. Rotor subjective noise levels appear to obey a velocity to the eighth power law, independent of thrust. Experiments to rectify some of the present deficiencies in knowledge are suggested.

73N19984* ISSUE 10 PAGE 1228 CATEGORY 23
73/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter visual aid system

UNOC: Improved visual capability for police helicopters

AUTH: A/BAISLEY, R. L.

CORP: Jet Propulsion Lab., California Inst. of Tech., Pasadena. CSS: (Guidance and Control Div.)
In its JPL Quart. Tech. Rev., Vol. 2, No. 4 p 72-86 (SEE N73-19975 10-34)

MAJS: /*HELICOPTERS/*POLICE/*VISUAL FIELDS

MINS: / DISPLAY DEVICES/ OPTICS/ SEARCHLIGHTS/ VISUAL OBSERVATION

ABA: Author

ABS: The results of an evaluation of police helicopter effectiveness revealed a need for improved visual capability. A JPL program developed a method that would enhance visual observation capability for both day and night usage and demonstrated the feasibility of the adopted approach. This approach made use of remote pointable optics, a display screen, a slaved covert searchlight, and a coupled camera. The approach was proved feasible through field testing and by judgement against evaluation criteria.

73N19014*# ISSUE 10 PAGE 1305 CATEGORY 2 RPT#: NASA-TT-F-14845 CNT#: NASW-2482 73/03/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Prediction of helicopter rotor loads

UNOC: Predicting loads and stresses on helicopter rotor blades

AUTH: A/GALLOT, J.

CORP: Linguistic Systems, Inc., Cambridge, Mass.
AVAIL.NTIS SAP: HC $3.00
Washington NASA Transl. into ENGLISH of the preprint ""Calcul des Charges sur Rotor d'Helicoptere'' Aerospatiale, Div. Helicopters, Etablissement de Marignane, Marseille, 1972 p 3.1 - 3.8

MAJS: /*HELICOPTER PERFORMANCE/*PERFORMANCE PREDICTION/* ROTARY WINGS

MINS: / AERODYNAMIC LOADS/ AERODYNAMICS/ STRESSES

ABA: Author

ABS: The correct design of a rotor requires a precise knowledge of the alternating loads to which blade and hub are submitted. The problem of the stress evaluation, from the early design stage, may lead to very sophisticated methods, because the blade is operating in a very complex environment. Nevertheless simplified methods may give sufficiently precise resDC 00000set up correctly the dimensions of the main elements of the rotor. The method described supposes simple aerodynamics, independent of blade elastic deformations. The degree of simplification achieved in

this theoretical method seems to be justified by the correlation obtained with experimental airloads measured on a model rotor at the Modane Wind Tunnel, and stresses recorded on the same rotor, or a full-scale semi-articulated rotor.

73N18996*# ISSUE 10 PAGE 1103 CATEGORY 1 RPT#: NASA-CR-2225 CNT#: NAS1-11049 73/03/00 94 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analysis of helicopter maneuver-loads and rotor-loads flight test data

UNOC: Analysis of airload and blade response of rotary wings to determine sources of rotor vibratory loads in level and maneuvering flight of NH-3A and CH-53A helicopters

AUTH: A/BENO, E. A.

CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $3.00 Washington NASA

MAJS: /*AERODYNAMIC LOADS/*HELICOPTER PERFORMANCE/*ROTARY WINGS/*VIBRATION MEASUREMENT

MINS: / AERODYNAMIC CONFIGURATIONS/ H-53 HELICOPTER/ STRESS ANALYSIS

ABA: Author

ABS: A study was conducted in which available airload and blade response data for the NH-3A and CH-53A rotors were analyzed in an attempt to provide greater insight into the sources of rotor vibratory loads in both level and maneuvering flight. Primary emphasis in the study was placed on examining and understanding causes of high-frequency rotor control loads. Secondary objectives were: (1) to examine the effect of number of rotor blades on hub vibratory shear forces and (2) to assess which of the many terms appearing in the hub vibratory shear force expression were of most significance.

73N18035*# ISSUE 9 PAGE 984 CATEGORY 2 RPT#: NASA-CR-114568 CNT#: NAS2-5168 72/09/00 2 VOLS 272 PAGES UNCLASSIFIED DOCUMENT

UTTL: Vibration and loads in hingeless rotors. Volume 2: Experimental data

UNOC: Descriptions, geometry, and technical data for three rotary wing systems used in determining vibration and loads in hingeless rotary wings - Vol. 2

AUTH: A/WATTS, G. A.; B/LONDON, R. J.

CORP: Lockheed-California Co., Van Nuys. CSS: (Rotary Wing Div.) AVAIL.NTIS SAP: HC $15.75

Sponsored in part by Army Air Mobility Res. and Develop. Lab.

MAJS: /*HELICOPTER PROPELLER DRIVE/*RIGID ROTORS/*ROTARY WINGS/*VIBRATION EFFECTS

MINS: / AERODYNAMIC CHARACTERISTICS/ HARMONIC EXCITATION/ STRESS ANALYSIS/ WIND TUNNEL MODELS

ABA: Author

ABS: Descriptions, geometry, and technical data covering three rotor systems are presented. Tables of experimental data gathered during wind tunnel testing of two of the systems are included. Both analyzed experimental data, ready for comparison with theory, and the basic reduced data from which they were obtained are reported.

73N18034*# ISSUE 9 PAGE 984 CATEGORY 2 RPT#: NASA-CR-114562 CNT#: NAS2-5168 72/09/00 2 VOLS 278 PAGES UNCLASSIFIED DOCUMENT

UTTL: Vibration and loads in hingeless rotors. Volume 1: Theoretical analyses

UNOC: Analytic methods for calculating blade loads and shaft-transmitted vibratory forces in stiff bladed hingeless rotors operating at various advance ratios - Vol. 1

AUTH: A/WATTS, G. A.; B/LONDON, R. J.

CORP: Lockheed-California Co., Van Nuys. CSS: (Rotary Wing Div.) AVAIL.NTIS SAP: HC $16.00

Sponsored in part by Army Air Mobility Res. and Develop. Lab.

MAJS: /*HELICOPTER PROPELLER DRIVE/*RIGID ROTORS/*ROTARY WINGS/*VIBRATION EFFECTS

MINS: / AERODYNAMIC CHARACTERISTICS/ BENDING MOMENTS/ HARMONIC EXCITATION/ NUMERICAL ANALYSIS

ABA: Author

ABS: Analytic methods are developed for calculating blade loads and shaft-transmitted vibratory forces in stiff bladed hingeless rotors operating at advance ratios from mu = .3 to mu = 2.0. Calculated shaft harmonic moments compared well with experimental values when the blade first flap frequency was in the region of two-per-revolution harmonic excitation. Calculated blade bending moment azimuthal distributions due to changes in cyclic pitch agreed well with experiment at radial stations near the blade root at values of the ratio of first flap frequency to rotor rotation rate from 1.5 to 5.0. At stations near the blade tip good agreement was only obtained at the higher values of frequency ratio.

73N17017*# ISSUE 8 PAGE 867 CATEGORY 2 RPT#: NASA-CR-114524 ASRL-TR-166-2 CNT#: NAS2-6175 71/10/00 67 PAGES UNCLASSIFIED DOCUMENT

UTTL: The nonlinear instability in flap-lag of rotor blades in forward flight

UNOC: Nonlinear instability in flap-lag of rotor blades in forward flight

AUTH: A/TONG, P.

CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Aeroelastic and Structures Research Lab.)
AVAIL.NTIS SAP: HC $5.50
MAJS: /*AERODYNAMIC STABILITY/*HELICOPTERS/*ROTOR AERODYNAMICS/*ROTOR BLADES
MINS: / DYNAMIC STABILITY/ FLUTTER/ NONLINEARITY/ PERTURBATION
ABA: Author
ABS: The nonlinear flap-lag coupled oscillation of torsionally rigid rotor blades in forward flight is examined using a set of consistently derived equations by the asymptotic expansion procedure of multiple time scales. The regions of stability and limit cycle oscillation are presented. The roles of parametric excitation, nonlinear oscillation, and forced excitation played in the response of the blade are determined.

73N16015*# ISSUE 7 PAGE 739 CATEGORY 2 RPT#: NASA-CR-114525 ASRL-TR-166-4 CNT#: NAS2-6175
72/08/00 19 PAGES UNCLASSIFIED DOCUMENT
UTTL: Investigation of some parameters affecting the stability of a hingeless helicopter blade in hover
UNOC: Application of equations of motion to investigate effects of mode shape and coning angle on stability boundaries of hingeless helicopter rotor blades
AUTH: A/FRIEDMANN, P.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Aeroelastic and Structures Research Lab.)
AVAIL.NTIS SAP: HC $3.00
MAJS: /*EQUATIONS OF MOTION/*HELICOPTER PERFORMANCE/*RIGID ROTORS/*ROTARY WINGS/*STABILITY DERIVATIVES
MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC CONFIGURATIONS/ AEROELASTICITY
ABA: Author
ABS: Equations of motion are used to investigate the effects of the choice of the mode shape and built-in coning angle on the stability boundaries of hingeless blades in hover. The results obtained indicate that the stability boundaries are dependent upon the mode shape to a considerable degree. It was also found that positive built-in coning is usually destabilizing while a negative amount of built-in coning can be quite stabilizing.

73N13028*# ISSUE 4 PAGE 372 CATEGORY 2 RPT#: NASA-CR-114489 D210-10508-1 CNT#: NAS2-5473
72/08/00 50 PAGES UNCLASSIFIED DOCUMENT
UTTL: Theory/test correlation of helicopter rotor blade element airloads in the blade stall regime
UNOC: Effects of aerodynamic stall on helicopter rotor blade element in three dimensional rotating environment
AUTH: A/BOBO, C. J.
CORP: Boeing Co., Philadelphia, Pa. CSS: (Vertol Div.)
AVAIL.NTIS SAP: HC $4.50
MAJS: /*AERODYNAMIC LOADS/*AERODYNAMIC STALLING/*HELICOPTERS /*ROTARY WINGS/*ROTOR BLADES
MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC CONFIGURATIONS/ SCALE MODELS
ABA: Author
ABS: The effects of stall on a rotor blade element in a three-dimensional rotating environment was investigated. The model rotor test provided blade element airloads and local boundary layer flow characteristics at the three-quarter blade radius position for a wide range of rotor operating conditions. A description of the test program and the test results are presented.

73N13014*# ISSUE 4 PAGE 371 CATEGORY 2 RPT#: NASA-TT-F-14637 CNT#: NASW-2035 72/12/00 45 PAGES UNCLASSIFIED DOCUMENT
UTTL: A vortex model for the study of the flow at the rotor blade of a helicopter
UNOC: Vortex model for calculating blade circulation flow of helicopter rotor
AUTH: A/ISAY, W. H.
CORP: Scientific Translation Service, Santa Barbara, Calif.
AVAIL.NTIS SAP: HC $4.25
Washington NASA Transl. into ENGLISH from Z. Angew. Math. Mech. (East Germany), v. 52, Jun. 1972 p 283-309
MAJS: /*FLOW DISTRIBUTION/*ROTARY WINGS/*ROTOR BLADES/*VORTICES
MINS: / AERODYNAMIC LOADS/ DYNAMIC MODELS/ HELICOPTERS
ABA: Author
ABS: On the base of unsteady vortex lifting line theory an approximate method to calculate the loading distribution on rotor blades in forward flight is presented. The theory takes account of the vortex wake geometry for nonuniform flow through the rotor disc as well as the effect of rolling up and contraction of free tip- and root-vortices. Calculating the blade circulation distribution requires careful attention to the case where the blades pass through the rolled-up tip- and root-vortex of the foregoing foil.

73N12042*# ISSUE 3 PAGE 252 CATEGORY 2 RPT#: NASA-CR-112194 CNT#: NAS1-11213 72/00/00 38 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotor blade boundary layer measurement hardware feasibility demonstration
UNOC: Development and characteristics of test facility for measuring three dimensional boundary layers on

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helicopter rotor blade under various conditions
AUTH: A/CLARK, D. R.; B/LAWTON, T. D.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft.) AVAIL.NTIS SAP: HC $4.00
Sponsored in part by USAAMRDL
MAJS: /*BOUNDARY LAYER FLOW/*ENVIRONMENTAL TESTS/*FLOW MEASUREMENT/*HELICOPTERS/*ROTARY WINGS/*TEST FACILITIES
MINS: / EQUIPMENT SPECIFICATIONS/ PERFORMANCE TESTS/ SYSTEMS ENGINEERING
ABA: Author
ABS: A traverse mechanism which allows the measurement of the three dimensional boundary layers on a helicopter rotor blade has been built and tested on a full scale rotor to full scale conditions producing centrifugal accelerations in excess of 400 g and Mach numbers of 0.6 and above. Boundary layer velocity profiles have been measured over a range of rotor speeds and blade collective pitch angles. A pressure scanning switch and transducer were also tested on the full scale rotor and found to be insensitive to centrifugal effects within the normal main rotor operating range. The demonstration of the capability to measure boundary layer behavior on helicopter rotor blades represents the first step toward obtaining, in the rotating system, data of a quality comparable to that already existing for flows in the fixed system.

73N11006*# ISSUE 2 PAGE 124 CATEGORY 1 RPT#: NASA-CR-2111 RASA-71-13-VOL-2 CNT#: NAS1-8448
72/09/00 164 PAGES UNCLASSIFIED DOCUMENT
UTTL: Main rotor free wake geometry effects on blade air loads and response for helicopters in steady maneuvers. Volume 2: Program listings
UNOC: Computer program listings for analysis of main rotor free wake geometry effects on blade air loads and response for helicopters in steady maneuvers - Vol. 2
AUTH: A/SADLER, S. G.
CORP: Rochester Applied Science Associates, Inc., N. Y.
AVAIL.NTIS SAP: HC $10.25
Washington
MAJS: /*AERODYNAMIC CHARACTERISTICS/*COMPUTER PROGRAMS/*HELICOPTER PERFORMANCE/*ROTARY WINGS
MINS: / AERODYNAMIC LOADS/ COMPUTER PROGRAMS/ MATHEMATICAL MODELS/ NUMERICAL ANALYSIS
ABA: Author
ABS: A mathematical model and computer program was implemented to study the main rotor free wake geometry effects on helicopter rotor blade air loads and response in steady maneuvers. Volume 1 (NASA CR-2110) contains the theoretical formulation and analysis of results. Volume 2 contains the computer program listing.

73N10135* ISSUE 1 PAGE 18 CATEGORY 5 CNT#: DA-28-043-AMC-02412(E) 72/00/00 7 PAGES
UNCLASSIFIED DOCUMENT
UTTL: A performance measure for manual control systems
UNOC: Phase margin measure for determining human operator control performance in multivariable closed loop system
AUTH: A/DUKES, T. A.; B/SUN, P. B.
CORP: Princeton Univ., N. J.
In NASA, Washington 7th Ann. Conf. on Manual Control p 257-263 (SEE N73-10104 01-05)
MAJS: /*FEEDBACK CONTROL/*MANUAL CONTROL/*OPERATOR PERFORMANCE/*PERFORMANCE PREDICTION
MINS: / HUMAN FACTORS ENGINEERING/ MAN MACHINE SYSTEMS/ OPTIMAL CONTROL/ PHASE CONTROL
ABA: Author
ABS: A new performance measure is introduced for multivariable closed loop experiments with a human operator. The essential feature of the phase margin performance measure (PMPM) is that the performance of each control loop can be determined inuependently, with prescribed disturbance and error levels. A variable filter parameter is used as the PMPM within the loop and it assures a high workload at the same time. There is a straightforward relationship between the PMPM and the inner loop feedback augmentation that can be utilized in trade-off studies. An adjustment scheme that seeks the PMPM automatically is described as employed in a single loop control task. This task applies directly to the experimental study of displays for helicopters and VTOL aircraft.

73N10019* ISSUE 1 PAGE 3 CATEGORY 4 72/10/00
11 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter crew/passenger vibration sensitivity -
UNOC: Analysis of helicopter pilot and passenger reaction to vibration environment to determine effects of discrete frequencies and combinations of harmonic frequencies
AUTH: A/GABEL, R.; B/REED, D. A.
CORP: Boeing Co., Philadelphia, Pa. CSS: (Vertol Div.)
In NASA, Langley Res. Center Symp. on Vehicle Ride Quality p 143-153 (SEE N73-10012 01-02)
MAJS: /*HELICOPTERS/*HUMAN FACTORS ENGINEERING/*HUMAN REACTIONS/*VIBRATION EFFECTS/*VIBRATION PERCEPTION
MINS: / ENVIRONMENTAL TESTS/ PHYSIOLOGICAL EFFECTS/ PSYCHOLOGICAL EFFECTS
ABA: Author
ABS: Helicopter crew and passenger vibration sensitivity are presented. Pilot subjective ratings are established for discrete frequencies and the impact of combinations of harmonic frequencies is examined. A passenger long term comfort level and a short term limit are defined for discrete frequencies and

compared with pilot ratings. The results show reasonable agreement between pilot and passenger. Subjective comfort levels obtained for mixed frequency environments clearly demonstrate the need for a multi-frequency criterion.

73N10015* ISSUE 1 PAGE 3 CATEGORY 2 72/10/00
16 PAGES UNCLASSIFIED DOCUMENT
UTTL: Ride quality criteria for large commercial helicopters
UNOC: Application of ride-quality criteria to design of commercial helicopters with emphasis on noise and vibration considerations
AUTH: A/SCHLEGEL, R. G.; B/STAVE, A. M.; C/WOLF, A. A.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.)
In NASA. Langley Res. Center Symp. on Vehicle Ride Quality p 51-66 (SEE N73-10012 01-02)
MAJS: /*AERODYNAMIC NOISE/*HELICOPTER DESIGN/*HUMAN FACTORS ENGINEERING/*VIBRATION EFFECTS
MINS: / COMFORT/ PHYSIOLOGICAL EFFECTS/ PSYCHOLOGICAL EFFECTS/ SAFETY FACTORS
ABA: Author
ABS: A review of major ride-quality criteria used in the design of commercial helicopters, some of the limitations of these criteria, research programs conducted to better define these criteria, and some recommended research programs is presented. Primary emphasis is given to the question of noise and vibration criteria for passenger acceptance and comfort.

72N33021*# ISSUE 24 PAGE 3167 CATEGORY 2 RPT#: NASA-CR-112157 CNT#: NAS1-11251 72/00/00 197 PAGES UNCLASSIFIED DOCUMENT
UTTL: A conceptual study of the rotor systems research aircraft
UNOC: Comparison of two helicopter design concepts developed to conduct rotary wing research project
CORP: Bell Helicopter Co., Fort Worth, Tex. AVAIL.NTIS SAP: HC $12.00
MAJS: /*AERODYNAMIC CHARACTERISTICS/*AIRCRAFT STABILITY/* COMPOUND HELICOPTERS/*HELICOPTER DESIGN
MINS: / AERODYNAMIC CONFIGURATIONS/ EQUIPMENT SPECIFICATIONS / HELICOPTER PERFORMANCE/ RESEARCH PROJECTS
ABA: Author
ABS: The analytical comparison of the two candidate Rotor Systems Research Aircraft (RSRA) configurations selected by the Government at the completion of Part 1 of the RSRA Conceptual Predesign Study is presented. The purpose of the comparison was to determine the relative suitability of both vehicles for the RSRA missions described in the Government Statement of Work, and to assess their versatility in the testing of new rotor concepts. The analytical comparison was performed primarily with regard to performance and stability and control. A weights, center-of-gravity, and inertia computation was performed for each iteration in the analysis process. The dynamics investigation was not concerned so much with a comparison of the two vehicles, but explored the dynamic problems attending operation of any RSRA operating with large rotor RPM and diameter ranges over large forward speed ranges. Several means of isolating in- and out-of-plane rotor vibrations were analyzed. An optimum isolation scheme was selected.

72N33020*# ISSUE 24 PAGE 3167 CATEGORY 2 RPT#: NASA-CR-112156 CNT#: NAS1-11251 72/00/00 83 PAGES UNCLASSIFIED DOCUMENT
UTTL: Predesign report for the rotor systems research aircraft
UNOC: Design, development, and aerodynamic characteristics of compound helicopter designed for rotor systems research applications
CORP: Bell Helicopter Co., Fort Worth, Tex. AVAIL.NTIS SAP: HC $6.25
MAJS: /*AERODYNAMIC CHARACTERISTICS/*COMPOUND HELICOPTERS/* HELICOPTER DESIGN/*ROTARY WINGS
MINS: / AERODYNAMIC CONFIGURATIONS/ HELICOPTER PERFORMANCE/ RESEARCH PROJECTS
ABA: Author
ABS: A conceptual predesign of a compound helicopter for conducting rotor research is presented. The aircraft was selected by the Government as the better of two concepts submitted. The helicopter is a three place vehicle in the 24,000 pound gross weight class. It has been determined that the helicopter satisfies the requirements for the rotor research mission. The model has been predesigned sufficiently to allow an assessment of its performance and stability and control characteristics. A brief treatment of these subjects is included.

72N33017*# ISSUE 24 PAGE 3167 CATEGORY 2 RPT#: NASA-CR-112155 SER-50775-VOL-4 CNT#: NAS1-11228 72/10/06 83 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotor systems research aircraft predesign study. Volume 4: Preliminary draft detail specification
UNOC: Design of rotor system research aircraft for flight testing advanced helicopter and compound rotor systems - Vol. 4 FLSP: Final Report
AUTH: A/MILLER, A. N.; B/LINDEN, A. W.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $6.25

MAJS: /*AIRCRAFT DESIGN/*FLIGHT TEST VEHICLES/*RESEARCH AIRCRAFT/*ROTARY WINGS
MINS: / AERODYNAMIC CONFIGURATIONS/ AIRFRAMES/ HELICOPTERS/ SPECIFICATIONS/ SYSTEMS ANALYSIS
ABA: D.L.G.
ABS: The RSRA requirements are presented in a detail specification format. Coverage of the requirements includes the following headings: (1) aircraft characteristics, (2) general features of design and construction, (3) aerodynamics, (4) structural design criteria, (5) flight control system, (6) propulsion subsystem, and (7) secondary power and distribution subsystem.

72N33016*# ISSUE 24 PAGE 3166 CATEGORY 2 RPT#: NASA-CR-112154 SER-50775-VOL-3 CNT#: NAS1-11228
72/10/06 186 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotor systems research aircraft predesign study. Volume 3: Predesign report
UNOC: Design of rotor system research aircraft for flight testing advanced helicopter and compound rotor systems - Vol. 3 TLSP: Final Report
AUTH: A/SCHMIDT, S. A.; B/LINDEN, A. W.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $11.50
MAJS: /*AIRCRAFT DESIGN/*FLIGHT TEST VEHICLES/*RESEARCH AIRCRAFT/*ROTARY WINGS
MINS: / AERODYNAMIC CONFIGURATIONS/ AIRFRAMES/ HELICOPTERS/ PERFORMANCE PREDICTION/ SYSTEMS ENGINEERING
ABA: Author
ABS: The features of two aircraft designs were selected to be included in the single RSRA configuration. A study was conducted for further preliminary design and a more detailed analysis of development plans and costs. An analysis was also made of foreseeable technical problems and risks, identification of parallel research which would reduce risks and/or add to the basic capability of the aircraft, and a draft aircraft specification.

72N33015*# ISSUE 24 PAGE 3166 CATEGORY 2 RPT#: NASA-CR-112153 SER-50775-VOL-2 CNT#: NAS1-11228
72/10/06 68 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotor systems research aircraft predesign study. Volume 2: Conceptual study report
UNOC: Design of rotor system research aircraft for flight testing advanced helicopter and compound rotor systems - Vol. 2 TLSP: Final Report
AUTH: A/SCHMIDT, S. A.; B/LINDEN, A. W.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $5.50
MAJS: /*AIRCRAFT DESIGN/*FLIGHT TEST VEHICLES/*RESEARCH AIRCRAFT/*ROTARY WINGS
MINS: / AERODYNAMIC CONFIGURATIONS/ AIRFRAMES/ HELICOPTERS/ PERFORMANCE PREDICTION/ SYSTEMS ENGINEERING
ABA: Author
ABS: The overall feasibility of the technical requirements and concepts for a rotor system research aircraft (RSRA) was determined. The designs of two aircraft were then compared against the RSRA requirements. One of these is an all new aircraft specifically designed as an RSRA vehicle. A new main rotor, transmission, wings, and fuselage are included in this design. The second aircraft uses an existing Sikorsky S-61 main rotor, an S-61 roller gearbox, and a highly modified Sikorsky S-67 airframe. The wing for this aircraft is a new design. Both aircraft employ a fan-in-fin anti-torque/yaw control system. T58-GE-16 engines for rotor power, and TF34-GE-2 turbofans for auxiliary thrust. Each aircraft meets the basic requirements and goals of the program. The all new aircraft has inflight variable main rotor shaft tilt, a side-by-side cockpit seating arrangement, and is slightly faster in the compound mode. It is also somewhat lighter since it uses new dynamic components specifically designed for the RSRA. Preliminary development plans, including schedules and costs, were prepared for both of these aircraft.

72N33014*# ISSUE 24 PAGE 3166 CATEGORY 2 RPT#: NASA-CR-112152 SER-50775-VOL-1 CNT#: NAS1-11228
72/10/06 28 PAGES UNCLASSIFIED DOCUMENT
UTTL: Rotor systems research aircraft of predesign study. Volume 1: Summary and conclusions
UNOC: Design of rotor system research aircraft for flight testing advanced helicopter and compound rotor systems - Vol. 1 TLSP: Final Report
AUTH: A/LINDEN, A. W.
CORP: United Aircraft Corp., Stratford, Conn. CSS: (Sikorsky Aircraft Div.) AVAIL.NTIS SAP: HC $3.50
MAJS: /*AIRCRAFT DESIGN/*FLIGHT TEST VEHICLES/*RESEARCH AIRCRAFT/*ROTARY WINGS
MINS: / AERODYNAMIC CONFIGURATIONS/ AIRFRAMES/ HELICOPTERS/ PERFORMANCE PREDICTION/ SYSTEMS ENGINEERING
ABA: Author
ABS: The results are summarized of a study to develop a versatile research aircraft for flight testing a wide variety of advanced helicopter and compound rotor systems. The aircraft is required to accept these rotors with minimal changes in the basic vehicle. Rotors envisioned for testing include conventional rotors plus variable geometry, variable twist, variable diameter, coaxial, jet flap, circulation control, and slowed rotors. Various disc loadings would be accommodated. The aircraft must be configured

to measure performance more accurately than past test vehicles. In addition, the aircraft would have a wing to off load the rotor while measuring performance during lightly loaded conditions. It would have variable drag and propulsive force so that the rotor can be tested while producing different values of horizontal force.

72N32995*# ISSUE 24 PAGE 3164 CATEGORY 1 RPT#: NASA-CR-2110 RASA-71-13-VOL-1 CNT#: NAS1-8448
72/09/00 109 PAGES UNCLASSIFIED DOCUMENT

UTTL: Main rotor free wake geometry effects on blade air loads and response for helicopters in steady maneuvers. Volume 1: Theoretical formulation and analysis of results

UNOC: Mathematical model and computer program for determining helicopter main rotor wake geometry effects on rotor blade air loads and response in steady maneuvers - Vol. 1

AUTH: A/SADLER, S. G.

CORP: Rochester Applied Science Associates, Inc., N. Y.
AVAIL.NTIS SAP: HC $3.00
Washington NASA

MAJS: /*AERODYNAMIC LOADS/*HELICOPTER PERFORMANCE/*HELICOPTER WAKES/*ROTARY WINGS

MINS: / AERODYNAMIC CHARACTERISTICS/ COMPUTER PROGRAMS/ NUMERICAL ANALYSIS

ABA: Author

ABS: A mathematical model and computer program were implemented to study the main rotor free wake geometry effects on helicopter rotor blade air loads and response in steady maneuvers. The theoretical formulation and analysis of results are presented.

72N30013*# ISSUE 21 PAGE 2776 CATEGORY 2 RPT#: NASA-CR-114464 D272-099-002 CNT#: NAS2-5461
72/05/00 195 PAGES UNCLASSIFIED DOCUMENT

UTTL: Large scale wind tunnel investigation of a folding tilt rotor

UNOC: Wind tunnel tests to determine aerodynamic characteristics of folding helicopter rotor in various configurations TLSP: Final Report

CORP: Bell Helicopter Co., Fort Worth, Tex. AVAIL.NTIS
SAP: HC $11.75

MAJS: /*AERODYNAMIC CHARACTERISTICS/*FOLDING STRUCTURES/*HELICOPTERS/*ROTARY WINGS

MINS: / AERODYNAMIC CONFIGURATIONS/ DATA ACQUISITION/ WIND TUNNEL STABILITY TESTS

ABA: Author

ABS: A twenty-five foot diameter folding tilt rotor was tested in a large scale wind tunnel to determine its aerodynamic characteristics in unfolded, partially folded, and fully folded configurations. During the tests, the rotor completed over forty start/stop sequences. After completing the sequences in a stepwise manner, smooth start/stop transitions were made in approximately two seconds. Wind tunnel speeds up through seventy-five knots were used, at which point the rotor mast angle was increased to four degrees, corresponding to a maneuver condition of one and one-half g.

72N29914* ISSUE 20 PAGE 2702 CATEGORY 2
72/00/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Fatigue failure of metal components as a factor in civil aircraft accidents

UNOC: Review of civil aviation accidents in US to determine incidents involving material failures

AUTH: A/HOLSHOUSER, W. L.; B/MAYNER, R. D.

CORP: National Transportation Safety Board, Washington, D. C.

In NASA. Langley Res. Center Advanced Approaches to Fatigue Evaluation p 611-630 (SEE N72-29895 20-32)

MAJS: /*AIRCRAFT ACCIDENTS/*CIVIL AVIATION/*FAILURE ANALYSIS/*FATIGUE (MATERIALS)

MINS: / INSPECTION/ MAINTENANCE/ RELIABILITY ENGINEERING/ STRUCTURAL FAILURE

ABA: Author

ABS: A review of records maintained by the National Transportation Safety Board showed that 16,054 civil aviation accidents occurred in the United States during the 3-year period ending December 31, 1969. Material failure was an important factor in the cause of 942 of these accidents. Fatigue was identified as the mode of the material failures associated with the cause of 155 accidents and in many other accidents the records indicated that fatigue failures might have been involved. There were 27 fatal accidents and 157 fatalities in accidents in which fatigue failures of metal components were definitely identified. Fatigue failures associated with accidents occurred most frequently in landing-gear components, followed in order by powerplant, propeller, and structural components in fixed-wing aircraft and tail-rotor and main-rotor components in rotorcraft. In a study of 230 laboratory reports on failed components associated with the cause of accidents, fatigue was identified as the mode of failure in more than 60 percent of the failed components. The most frequently identified cause of fatigue, as well as most other types of material failures, was improper maintenance (including inadequate inspection). Fabrication defects, design deficiencies, defective material, and abnormal service damage also caused many fatigue failures. Four case histories of major accidents are included in the paper

as illustrations of some of the factors involved in fatigue failures of aircraft components.

72N29900* ISSUE 20 PAGE 2760 CATEGORY 32
72/00/00 17 PAGES UNCLASSIFIED DOCUMENT
UTTL: The practical implementation of fatigue requirements to military aircraft and helicopters in the United Kingdom
UNOC: Fatigue requirements for ensuring structural integrity of military aeroplanes and helicopters
AUTH: A/MAXWELL, R. D. J.
CORP: Royal Aircraft Establishment, Farnborough (England). In NASA. Langley Res. Center Advanced Approaches to Fatigue Evaluation te p 213-229 (SEE N72-29895 20-32)
MAJS: /*AIRCRAFT DESIGN/*AIRCRAFT RELIABILITY/*FATIGUE LIFE /*MILITARY AIRCRAFT/*MILITARY HELICOPTERS
MINS: / AIRCRAFT STRUCTURES/ LOADS (FORCES)/ SERVICE LIFE/ SPECIFICATIONS
ABA: Author
ABS: The methods adopted in the United Kingdom to ensure the structural integrity of military aeroplanes and helicopters from the fatigue point of view are described. The procedure adopted from the writing of the specification to the monitoring of fatigue life in service are presented along with the requirements to be met and the way in which they are satisfied. Some of the outstanding problems that remain to be solved are indicated.

72N29226*# ISSUE 20 PAGE 2668 CATEGORY 12
RPT#: NASA-CR-112129 ASRL-TR-153-1 CNT#:
NGR-22-009-303 70/01/00 34 PAGES UNCLASSIFIED DOCUMENT
UTTL: Leading-edge pressure measurements of airfoil vortex interaction
UNOC: Experimental pressure-differential measurements made at 10 percent chord of airfoil-vortex interaction
AUTH: A/WALSH, R. G., JR.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Aeroelastic and Structures Research Lab.)
AVAIL.NTIS SAP: HC $3.75
MAJS: /*AIRFOILS/*PRESSURE MEASUREMENT/*VORTICES
MINS: / FREE FLOW/ LEADING EDGES/ ROTARY WING AIRCRAFT/ VELOCITY
ABA: Author
ABS: Experimental pressure-differential measurements made at 10% chord of an airfoil-vortex interaction are presented. A line vortex was oscillated over an airfoil perpendicular to the span and parallel to the chord. The pressure time history was recorded in order to show the sharp pressure pulses resulting from the bursting of the vortex core as it impinges upon the airfoil. Results for various vortex sizes and free stream velocities were obtained. Measurements were also made when the airfoil was yawed to the line vortex. Maximum pressure differences were observed to occur in phase across the blade even with yaw, and were directly proportional to the square of the free stream velocity. The maximum dynamic pressure coefficients obtained were as high as 1.0 when vortex bursting occurred.

72N29009*# ISSUE 20 PAGE 2637 CATEGORY 2 RPT#:
NASA-CR-112101 CNT#: NAS1-10459 72/08/28 68 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Application of boron/epoxy reinforced aluminum stringers and boron/epoxy skid gear for the CH54B helicopter tail cone. Phase 2: Fabrication, inspection and flight test
UNOC: Construction of CH-54 helicopter components from boron/epoxy materials and quality control program to determine service life of components TLSP: Final Report, May 1971 - Mar. 1972
AUTH: A/WELGE, R. T.
CORP: United Aircraft Corp., Stratford, Conn. AVAIL.NTIS SAP: HC $5.50
Sponsored in part by Army
MAJS: /*BORON COMPOUNDS/*CH-54 HELICOPTER/*COMPOSITE MATERIALS/*EPOXY RESINS/*HELICOPTER DESIGN
MINS: / AIRFRAMES/ FLIGHT TESTS/ PRODUCTION ENGINEERING/ QUALITY CONTROL/ RELIABILITY ENGINEERING
ABA: Author
ABS: A CH-54B Skycrane helicopter was fabricated with boron/epoxy reinforced stringers in the tail cone and boron/epoxy tubes in the tail skid. The fabrication of the tail cone was made with conventional tooling, production shop personnel, and no major problems. The flight test program includes a stress and vibration survey using strain gages and vibration transducers located in critical areas. The program to inspect and monitor the reliability of the components is discussed.

72N28002*# ISSUE 19 PAGE 2504 CATEGORY 2 RPT#:
NASA-CR-112030 CNT#: NAS1-10365 72/05/00 96 PAGES
UNCLASSIFIED DOCUMENT
UTTL: A performance application study of a jet-flap helicopter rotor
UNOC: Application of jet-flap to reaction drive rotor for heavy lift high speed helicopter
AUTH: A/SULLIVAN, R. J.; B/LAFORGE, S.; C/HOLCHIN, B. W.
CORP: Hughes Tool Co., Culver City, Calif. CSS: (Aircraft Div.) AVAIL.NTIS SAP: HC $7.00

Washington NASA

MAJS: /*HELICOPTERS/*HIGH SPEED/*JET FLAPS/*ROTOR LIFT
MINS: / LIFT/ MANEUVERABILITY/ MECHANICAL DRIVES/ ROTOR SPEED
ABA: Author
ABS: A performance study was made of the application of a jet-flap to a reaction-drive rotor for a heavy-lift helicopter mission and for a high-speed-helicopter maneuverability (200 knots, 2g) mission. The results of the study are as follows: As a result of the increase in maximum airfoil lift coefficient achieved by the jet-flap, rotor solidity is reduced with the jet-flap to approximately 59% of a nonjet-flap rotor. As a result of the saving in rotor solidity, and hence in rotor weight, the jet-flap configuration had a 21% higher productivity than a nonjet-flap configuration. Of the three propulsion systems studied utilizing a jet-flap (hot cycle, warm cycle, cold cycle) the hot cycle gave the largest increase in productivity. The 200 knot 2g mission is performed best with a warm cycle propulsion system. The jet-flap permits designing for a rotor blade loading coefficient C sub T/sigma = .170 at 2g without encountering blade stall. The jet-flap rotor permits a 200 knot 2g maneuver without suffering the penalty of an unreasonable rotor solidity that would be required by a nonjet-flap rotor.

72N28001*# ISSUE 19 PAGE 2504 CATEGORY 2 RPT#: NASA-TT-F-14281 CNT#: NASW-2037 72/06/00 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Structural stability considerations in the rotor system of the hot gas jet helicopter DO132
UNOC: Structural analysis of rotor system of hot gas-jet helicopter
AUTH: A/BRENNER, L.
CORP: Techtran Corp., Glen Burnie, Md. AVAIL.NTIS SAP: HC $3.25
Washington NASA Conf. held in Immenstaad, West Ger., 24 Jun. 1969 Transl. into ENGLISH from Helicopter Fatigue Testing, Proc. of the DGLR Symp. on Helicopters and Propellers Stuttgart, DGLR, Dec. 1970 p 77-96, 177
MAJS: /*HELICOPTERS/*ROTARY WINGS/*STRESS ANALYSIS/* STRUCTURAL ANALYSIS
MINS: / ENGINEERING DRAWINGS/ VIBRATION EFFECTS/ VIBRATION TESTS
ABA: Author
ABS: The rotor system of a hot gas-jet helicopter is examined from the standpoint of resistance to vibration and stress on the structured system of the blades. The following subjects are discussed: (1) technical structural data of the helicopter, (2) construction of the rotor system, (3) principles of measurement for the structural stability of the rotor system, and (4) the operating test plan for the test blade. Engineering drawings of the helicopter systems and stress diagrams resulting from the tests are included.

72N28000*# ISSUE 19 PAGE 2504 CATEGORY 2 RPT#: NASA-TT-F-14282 CNT#: NASW-2037 72/05/00 29 PAGES UNCLASSIFIED DOCUMENT

UTTL: Dynamic testing of helicopter components
UNOC: Application of dynamic component testing for development of helicopters to show test planning and execution
AUTH: A/SCHUMACHER, H.
CORP: Techtran Corp., Glen Burnie, Md. AVAIL.NTIS SAP: HC $3.50
Washington NASA Conf. held in Immenstaad, West Ger., 24 Jun. 1969 Transl. into ENGLISH from Helicopter Fatigue Testing, Proc. of the DGLR Symp. on Helicopters and Propellers Stuttgart, DGLR, Dec. 1970 p 97-123
MAJS: /*AIRCRAFT EQUIPMENT/*HELICOPTER DESIGN/*PERFORMANCE TESTS/*STRUCTURAL DESIGN
MINS: / AIRCRAFT PARTS/ EQUIPMENT SPECIFICATIONS/ MATERIALS TESTS
ABA: Author
ABS: The importance of dyna ic component testing for the development of helicopters is presented. Using the development of the BO 105 as an example, the test planning and execution used demonstrate the multiplicity and range of the test purposes. Various tests are presented in a series of figures for clarification.

72N27999*# ISSUE 19 PAGE 2504 CATEGORY 2 RPT#: NASA-CR-112071 RASA-72-01 CNT#: NAS1-11216 72/00/00 135 PAGES UNCLASSIFIED DOCUMENT

UTTL: Blade frequency program for nonuniform helicopter rotors, with automated frequency search
UNOC: Computer program for determining natural frequencies and normal modes existing in helicopter rotary wings TLSP: Informal Final Report
AUTH: A/SADLER, S. G.
CORP: Rochester Applied Science Associates, Inc., N. Y. AVAIL.NTIS SAP: HC $8.75
MAJS: /*HELICOPTERS/*ROTARY WINGS/*STRESS ANALYSIS/* STRUCTURAL ANALYSIS
MINS: / COMPUTER PROGRAMS/ ELASTIC PROPERTIES/ VIBRATION EFFECTS
ABA: Author
ABS: A computer program for determining the natural

frequencies and normal modes of a lumped parameter model of a rotating, twisted beam, with nonuniform mass and elastic properties was developed. The program is used to solve the conditions existing in a helicopter rotor where the outboard end of the rotor has zero forces and moments. Three frequency search methods have been implemented. Including an automatic search technique, which allows the program to find up to the fifteen lowest natural frequencies without the necessity for input estimates of these frequencies.

72N24993*# ISSUE 16 PAGE 2095 CATEGORY 1 RPT#: NASA-TT-F-14283 DLR-MITT-70-01 CNT#: NASW-2035 72/05/00 32 PAGES UNCLASSIFIED DOCUMENT

UTTL: Evaluation of flight measurements and plotting of load collectives

UNOC: Applications of computers for flight test and evaluation of helicopters based on frequency analyses of load curves on main and tail rotors

AUTH: A/STREHLOW, H.; B/MIHALCEA, N.

CORP: Scientific Translation Service, Santa Barbara, Calif.

AVAIL.NTIS SAP: HC $3.75

Washington NASA Transl. into ENGLISH from Proc. of DGLR Symp. on Helicopters and Propellers, Immenstaad, West Germany, 24 Jun. 1969, report DLR-MITT-70-01, Dec. 1970 p 124-156

MAJS: /*COMPUTER PROGRAMS/*DATA PROCESSING EQUIPMENT/*FLIGHT TESTS/*HELICOPTERS

MINS: / AERODYNAMIC LOADS/ NUMERICAL ANALYSIS/ ROTARY WINGS/ VIBRATION TESTS

ABA: Author

ABS: The practical application of computers to the development and flight testing of helicopters is discussed. By classifying the dynamic stresses and establishing the spectral power density of measured vibration curves, load collective and damage criteria are established. Potential applications in the solution of various serviceability problems are described. The evaluation methods used and the necessary employment of electronic data processing equipment are explained.

72N24531*# ISSUE 15 PAGE 2033 CATEGORY 15 RPT#: NASA-TT-F-14280 CNT#: NASW-2035 72/05/00 77 PAGES UNCLASSIFIED DOCUMENT

UTTL: Determination of the lifetime of helicopter components

UNOC: Development of methods for determining lifetime of helicopter components based on working stress and stress-time functions

AUTH: A/PRINZ, R.

CORP: Scientific Translation Service, Santa Barbara, Calif.

AVAIL.NTIS SAP: HC $6.00

Washington NASA Transl. into ENGLISH from Proc. of DGLR Symp. on Helicopters and Propellers, Immenstaat, West Germany, 24 Jun. 1969

MAJS: /*HELICOPTERS/*ROTARY WINGS/*SERVICE LIFE/*STRESS ANALYSIS

MINS: / PERFORMANCE PREDICTION/ RELIABILITY ENGINEERING/ STATISTICAL ANALYSIS

ABA: Author

ABS: Methods which are used, or are to be used in the future, for determining the lifetime of helicopter components are discussed. These methods are based on the determination of the working stress. Calculated or measured stress-time functions are studied, and both analytical and experimental methods are given for the statistical evaluation of these functions. The use of a unit collective for fatigue studies on rotor blades is also recommended, on the basis of various stress collectives reported in the bibliography. This unit collective can serve as the basis for fatigue studies. Some possibilities for carrying out fatigue studies are stated, and the necessity for statistical evaluation of test results is mentioned. Some methods for determining lifetime on the basis of the fluctuating stresses are presented.

72N24025*# ISSUE 15 PAGE 1966 CATEGORY 2 RPT#: NASA-CR-2043 D-210-10392-1 CNT#: NAS1-10044 72/06/00 90 PAGES UNCLASSIFIED DOCUMENT

UTTL: Acceptability of VTOL aircraft noise determined by absolute subjective testing

UNOC: Acceptability of VTOL aircraft noise determined by test subjects evaluating simulated sounds of helicopter, tilt wing aircraft, and turbojet aircraft

AUTH: A/STERNFELD, H., JR.; B/HINTERKEUSER, E. G.; C/HACKMAN, R. B.; D/DAVIS, J.

CORP: Boeing Co., Philadelphia, Pa. CSS: (Vertol Div.)

AVAIL.NTIS SAP: HC $3.00

Washington NASA

MAJS: /*ACOUSTIC MEASUREMENT/*AIRCRAFT NOISE/*HUMAN TOLERANCES/*VERTICAL TAKEOFF AIRCRAFT

MINS: / HELICOPTERS/ JET AIRCRAFT/ PHYSIOLOGICAL TESTS/ SIMULATION/ TILT WING AIRCRAFT

ABA: Author

ABS: A program was conducted during which test subjects evaluated the simulated sounds of a helicopter, a tilt wing aircraft, and a 15 second, 90 PNdB (indoors) turbojet aircraft used as reference. Over 20,000 evaluations were made while the test subjects were engaged in work and leisure activities. The effects of level, exposure time, distance and aircraft design on subjective acceptability were evaluated. Some of the important conclusions are: (1) To be judged equal in annoyance to the reference jet sound, the helicopter

and tilt wing sounds must be 4 to 5 PNdB lower when lasting 15 seconds in duration. (2) To be judged significantly more acceptable than the reference jet sound, the helicopter sound must be 10 PNdB lower when lasting 15 seconds in duration. (3) To be judged significantly more acceptable than the reference jet sound, the tilt wing sound must be 12 PNdB lower when lasting 15 seconds in duration. (4) The relative effect of changing the duration of a sound upon its subjectively rated annoyance diminishes with increasing duration. It varies from 2 PNdB per doubling of duration for intervals of 15 to 30 seconds, to 0.75 PNdB per doubling of duration for intervals of 120 to 240 seconds.

72N23024*# ISSUE 14 PAGE 1827 CATEGORY 2 RPT#: NASA-TT-F-676 CNT#: NASW-2035 72/05/00 292 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter aerodynamics

UNOC: Principles of helicopter flight with emphasis on main rotor performance and aerodynamic forces imposed on helicopter during maneuvers

AUTH: A/BAZOV, D. I.

CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS SAP: HC $3.00
Washington NASA Transl. into ENGLISH of the book ""Aerodinamika Vertoletov'' Moscow, Transport Press, 1969 p 1-190

MAJS: /*AERODYNAMIC CHARACTERISTICS/*AERODYNAMIC FORCES/*HELICOPTERS/*ROTARY WINGS

MINS: / AUTOROTATION/ HELICOPTER CONTROL/ HELICOPTER PERFORMANCE

ABA: Author

ABS: Principles of helicopter flight under various conditions are reviewed, giving special attention to the operation of the main rotor. A brief history of helicopter development is presented, together with a summary of the main components of a helicopter and a classification of the various types of helicopters. The characteristics of the main rotor and its operation during autorotation and during axial and oblique flow are considered. Also considered are vertical and horizontal flight, altitude gain and descent, takeoff and landing, equilibrium, stability, and controllability, taking into account the aerodynamic forces acting on the helicopter during the various maneuvers.

72N22022*# ISSUE 13 PAGE 1691 CATEGORY 2 RPT#: NASA-CR-112052 CNT#: NAS1-10103 72/00/00 60 PAGES UNCLASSIFIED DOCUMENT

UTTL: Design, fabrication and testing of two electrohydraulic vibration isolation systems for helicopter environments

UNOC: Design, development, and evaluation of electrohydraulic vibration isolation systems for reducing vertical vibrations caused by helicopter rotary wings

AUTH: A/ALLEN, R. E.; B/CALCATERRA, P. C.

CORP: Barry Wright Corp., Watertown, Mass. AVAIL.NTIS

MAJS: /*HELICOPTER DESIGN/*HELICOPTER PERFORMANCE/*ROTARY WINGS/*VIBRATION ISOLATORS

MINS: / PERFORMANCE TESTS/ SYSTEMS ENGINEERING/ VIBRATION MEASUREMENT

ABA: Author

ABS: Two electrohydraulic vibration isolation systems were designed and fabricated to reduce the vertical vibrations transmitted to the XH-51N research helicopter cabin at the blade passage frequency (18 Hz) and its first harmonic (36 Hz). Hydraulic power and electrical control are provided to two separate servoactuators from a common power supply and control electronics package located behind the pilot's seat. One servoactuator is installed between the cabin and fuselage and replaces an existing passive spring. A second servoactuator is mounted between the existing seat and cabin floor. Both servoactuators incorporate a mechanical failsafe design. The control electronics circuitry provides automatic tracking of the blade passage frequency. Results of laboratory, environmental and ground vibration tests employing an XH-51A stripped down helicopter fuselage show that the active cabin isolator reduces the vertical vibrations transmitted from the fuselage attachment point to the cabin attachment point at 18 and 36 Hz (or as an alternative, 6 Hz) by better than 90 percent.

72N19026*# ISSUE 10 PAGE 1283 CATEGORY 2 RPT#: NASA-CR-1983 CNT#: NGR-52-025-002 72/03/00 71 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter noise: Blade slap. Part 2: Experimental results

UNOC: Flight tests to determine characteristics of blade slap in rotary wings and effect on helicopter performance

AUTH: A/LEVERTON, J. W.

CORP: Southampton Univ. (England). CSS: (Inst. of Sound and Vibration Research.) AVAIL.NTIS
Washington NASA

MAJS: /*AERODYNAMIC NOISE/*FLIGHT TESTS/*HELICOPTER PERFORMANCE/*ROTARY WINGS

MINS: / AERODYNAMIC CHARACTERISTICS/ AEROELASTICITY/ NOISE INTENSITY
ABA: Author
ABS: Blade slap encountered in rotary wings and its effect on helicopter performance are reported. The results of various individual flight tests are presented and, where possible, correlated with one another. Observations from the subjective evaluation of blade slap are included, together with a modified form of the blade slap factor (BSF) which can be used as a design criteria.

72N18005*# ISSUE 9 PAGE 1148 CATEGORY 2 RPT#: NASA-CR-114424 D210-10347-1 CNT#: NAS2-5473 71/09/00 120 PAGES UNCLASSIFIED DOCUMENT
UTTL: An experimental investigation of the helicopter rotor blade element airloads on a model rotor in the blade stall regime
UNOC: Wind tunnel tests of models of helicopter rotary wings to determine blade element airloads in unstalled and stalled flight regimes
AUTH: A/FISHER, R. K., JR.; B/TOMPKINS, J. E.; C/BOBO, C. J.; D/CHILD, R. F.
CORP: Boeing Co., Philadelphia, Pa. CSS: (Vertol Div.) AVAIL.NTIS
MAJS: /*AERODYNAMIC LOADS/*HELICOPTER PERFORMANCE/*ROTARY WINGS/*WIND TUNNEL MODELS
MINS: / AERODYNAMIC STALLING/ CH-47 HELICOPTER/ PERFORMANCE PREDICTION/ PRESSURE DISTRIBUTION
ABA: Author
ABS: A wind tunnel test program was conducted on an eight foot diameter model rotor system to determine blade element airloads characteristics in the unstalled and stalled flight regimes. The fully articulated model rotor system utilized three blades with a Vertol 23010-1.58 airfoil section, the blades being 1/7.5 scale models of the CH-47C rotor blades. Instrumentation was incorporated at the blade 75% radial station to measure pressure and skin friction distributions, surface streamline directions and local angle of attack. The test program was conducted in three phases; non-rotating, hover and forward flight at advance ratios of 0.15, 0.35 and 0.60. Test data were analyzed with respect to providing insight to the mechanisms affecting blade stall, particularly retreating blade stall during forward flight conditions. From such data, an assessment was made as to the applicability of current theoretical analyses used for the prediction of blade element airloads in the stall regime.

72N15943*# ISSUE 7 PAGE 843 CATEGORY 1 RPT#: NASA-CR-1948 CNT#: NGR-11-002-121 72/02/00 48 PAGES UNCLASSIFIED DOCUMENT
UTTL: Exploratory investigation of sound pressure level in the wake of an oscillating airfoil in the vicinity of stall
UNOC: Wind tunnel investigation of sound pressure intensity level in wake of oscillating airfoil and flat plate during helicopter stall
AUTH: A/GRAY, R. B.; B/PIERCE, G. A.
CORP: Georgia Inst. of Tech., Atlanta. AVAIL.NTIS Washington NASA
MAJS: /*AIRFOILS/*FLAT PLATES/*HELICOPTER WAKES/*SOUND INTENSITY
MINS: / OSCILLATING FLOW/ SOUND PRESSURE/ WIND TUNNEL STABILITY TESTS
ABA: Author
ABS: Wind tunnel tests were performed on two oscillating two-dimensional lifting surfaces. The first of these models had an NACA 0012 airfoil section while the second simulated the classical flat plate. Both of these models had a mean angle of attack of 12 degrees while being oscillated in pitch about their midchord with a double amplitude of 6 degrees. Wake surveys of sound pressure level were made over a frequency range from 16 to 32 Hz and at various free stream velocities up to 100 ft/sec. The sound pressure level spectrum indicated significant peaks in sound intensity at the oscillation frequency and its first harmonic near the wake of both models. From a comparison of these data with that of a sound level meter, it is concluded that most of the sound intensity is contained within these peaks and no appreciable peaks occur at higher harmonics. It is concluded that within the wake the sound intensity is largely pseudosound while at one chord length outside the wake, it is largely true vortex sound. For both the airfoil and flat plate the peaks appear to be more strongly dependent upon the airspeed than on the oscillation frequency. Therefore reduced frequency does not appear to be a significant parameter in the generation of wake sound intensity.

72N12992* ISSUE 4 PAGE 430 CATEGORY 2 RPT#: NASA-CR-112009 CNT#: NGR-22 009-303 71/09/30 4 PAGES UNCLASSIFIED DOCUMENT
UTTL: Investigation of rotor blade tip-vortex aerodynamics
UNOC: Aerodynamics of helicopter rotor blade tip vortices TLSP: Final Report, 1 Jun. 1968 - 30 Sep. 1971
AUTH: A/LEWELLEN, W. S.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (Aeroelastic and Structures Research Lab.) AVAIL.NTIS
MAJS: /*AERODYNAMICS/*BLADE TIPS/*HELICOPTERS/*ROTOR BLADES

/*VORTICES
MINS: / DYNAMIC LOADS/ FLOW VELOCITY/ PRESSURE GRADIENTS/ TRAILING EDGES
ABA: E.H.W.
ABS: Several aspects of the aerodynamics of rotor blade tip vortices are examined. Two particular categories are dealt with; (1) dynamic loads on a blade passing close to or intersecting a trailing vortex, and (2) the response of the trailing vortex core to changes in the flow. Results for both categories are in reasonable agreement with existing data, although lower pressure gradients were obtained than anticipated for category one. A correlation between trailing edge sweep angle at the tip and vortex core size was noted for category two.

72N12988*# ISSUE 4 PAGE 430 CATEGORY 2 RPT#: NASA-CR-1883 CNT#: NAS1-9257 71/10/00 147 PAGES
UNCLASSIFIED DOCUMENT
UTTL: An evaluation of methods for scaling aircraft noise perception
UNOC: Accuracy of aircraft noise rating procedure relative to perceived sound levels
AUTH: A/OLLERHEAD, J. B.
CORP: Wyle Labs., Inc., Hampton, Va. AVAIL.NTIS
Washington NASA
MAJS: /*AIRCRAFT NOISE/*EFFECTIVE PERCEIVED NOISE LEVELS/*NOISE INTENSITY/*PSYCHOACOUSTICS
MINS: / ACOUSTIC MEASUREMENT/ AUDITORY STIMULI/ RATINGS/ SOUND WAVES
ABA: Author
ABS: One hundred and twenty recorded sounds, including jets, turboprops, piston engined aircraft and helicopters were rated by a panel of subjects in a paired comparison test. The results were analyzed to evaluate a number of noise rating procedures in terms of their ability to accurately estimate both relative and absolute perceived noise levels. It was found that the complex procedures developed by Stevens, Zwicker and Kryter are superior to other scales. The main advantage of these methods over the more convenient weighted sound pressure level scales lies in their ability to cope with signals over a wide range of bandwidth. However, Stevens' loudness level scale and the perceived noise level scale both overestimate the growth of perceived level with intensity because of an apparent deficiency in the band level summation rule. A simple correction is proposed which will enable these scales to properly account for the experimental observations.

71N37594*# ISSUE 24 PAGE 3871 CATEGORY 1 RPT#: NASA-CR-114362 CNT#: NAS2-5168 71/05/00 312 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Trim, control, and stability of a gyro-stabilized hingeless rotor at high advance ratio and low rotor speed
UNOC: Development of methods for measuring and predicting behavior of rigid rotors with stiff blades at high advance ratios and low rotor speeds
AUTH: A/WATTS, G. A.; B/LONDON, R. J.; C/SNODDY, R. J.
CORP: Lockheed-California Co., Van Nuys. CSS: (Rotary Wing Div.) AVAIL.NTIS
MAJS: /*AERODYNAMIC CHARACTERISTICS/*PERFORMANCE PREDICTION /*RIGID ROTORS/*ROTARY WINGS
MINS: / HELICOPTER CONTROL/ HELICOPTER DESIGN/ HELICOPTER PERFORMANCE

71N37593*# ISSUE 24 PAGE 3871 CATEGORY 1 RPT#: NASA-TT-F-13988 CNT#: NASW-2035 71/10/00 49 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Review of testing techniques for transonic airfoils
UNOC: Two dimensional flow tests of transonic airfoils
AUTH: A/BAZIN, M.
CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS
Washington NASA Presented to 7th Colloq. on Appl. Aerodyn, Rhone, France, 4-6 Nov. 1970; sponsored by Assoc. Franc. Des Ingr. et Techniciens de l'Aeronaut. et de l'Espace Transl. into ENGLISH from ONERA preprint of conf. paper
MAJS: /*AIRFOILS/*TRANSONIC SPEED/*TWO DIMENSIONAL FLOW
MINS: / HELICOPTERS/ ROTARY WINGS/ WALL FLOW/ WIND TUNNELS

71N35210*# ISSUE 22 PAGE 3539 CATEGORY 2 RPT#: NASA-CR-114339 CNT#: NAS2-5972 71/06/00 376 PAGES
UNCLASSIFIED DOCUMENT
UTTL: Technology assessment of advanced general aviation aircraft
UNOC: Potential impact of advanced technology in 1985 on four types of general aviation aircraft including STOL V/STOL, and helicopters TLSP, Final Report
AUTH: A/HURKAMP, C. H.; B/JOHNSTON, W. M.; C/WILSON, J. H.
CORP: Lockheed-Georgia Co., Marietta. CSS: (Advanced Concepts Dept.) AVAIL.NTIS SAP: HC $6.00/MF $0.95
MAJS: /*GENERAL AVIATION AIRCRAFT/*HELICOPTERS/*SHORT TAKEOFF AIRCRAFT/*TECHNOLOGY ASSESSMENT
MINS: / AERODYNAMICS/ AIRCRAFT SAFETY/ COST ESTIMATES

71N32797*# ISSUE 19 PAGE 3039 CATEGORY 2 RPT#: NASA-CR-1818 REPT-70-07-PT-1 CNT#: NAS1-9496 71/08/00 71 PAGES UNCLASSIFIED DOCUMENT
UTTL: The effects of nonuniform swash-plate stiffness on coupled blade-control system dynamics and stability. Part 2 - Computer program listing
UNOC: Computer program for calculating effects of swash-plate stiffness on helicopter rotor system dynamics and stability
AUTH: A/PIARULLI, V. J.
CORP: Rochester Applied Science Associates, Inc., N. Y. AVAIL.NTIS SAP: AVAIL- NTIS WASHINGTON NASA
MAJS: /*COMPUTER PROGRAMS/*DYNAMIC RESPONSE/*FLEXIBLE BODIES /*HELICOPTERS/*ROTARY WINGS
MINS: / LAPLACE TRANSFORMATION/ MATRICES (MATHEMATICS)/ STABILITY/ VIBRATION MODE

71N20719*# ISSUE 10 PAGE 1492 CATEGORY 2 RPT#: NASA-TT-F-636 CNT#: NASW-2035 71/03/00 325 PAGES UNCLASSIFIED DOCUMENT
UTTL: Control systems for single-rotor helicopters
UNOC: Control system designs for USSR single-rotor helicopters including controllability characteristics, rotors with control gyroscopes, and transfer functions in closed loop systems
AUTH: A/DMITRIYEV, I. S.
CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS WASHINGTON NASA TRANSL. INTO ENGLISH OF THE BOOK ''SISTEMY UPR. ODNOVINTOVYKH VERTOLETOV'' MOSCOW, MASHINOSTR., 1969 325 P
MAJS: /*CONTROL MOMENT GYROSCOPES/*CONTROLLABILITY/*FEEDBACK CONTROL/*HELICOPTER CONTROL/*TRANSFER FUNCTIONS/* U.S.S.R.
MINS: / AERODYNAMIC STABILITY/ HELICOPTERS/ ROTARY WINGS/ SYSTEMS ENGINEERING

71N20421*# ISSUE 9 PAGE 1325 CATEGORY 2 RPT#: NASA-CR-114290 LR-24122 CNT#: NAS2-5419 71/02/00 220 PAGES UNCLASSIFIED DOCUMENT
UTTL: Research program to determine rotor response characteristics at high advance ratios Final report
UNOC: Stability and response characteristics of directly controlled rigid rotors at high advance ratios and correlation of mathematical model with wind tunnel test data
AUTH: A/KUCZYNSKI, W. A.; B/SISSINGH, G. J.
CORP: Lockheed-California Co., Burbank. AVAIL.NTIS SPONSORED IN PART BY ARMY
MAJS: /*AERODYNAMIC STABILITY/*MATHEMATICAL MODELS/*ROTOR AERODYNAMICS/*STATISTICAL CORRELATION/*WIND TUNNEL STABILITY TESTS
MINS: / AERODYNAMIC COEFFICIENTS/ ANGLE OF ATTACK/ GRAPHS (CHARTS)/ HELICOPTERS/ PITCHING MOMENTS/ STATIC TESTS/ WIND TUNNEL MODELS

71N20113*# ISSUE 9 PAGE 1332 CATEGORY 4 RPT#: NASA-CR-117181 CNT#: NASW-1829 70/04/07 101 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effects of noise and vibration on commercial helicopter pilots. Results of Phase 1 research Final report
UNOC: Noise and vibration effects on commercial helicopter pilot safety, performance, and comfort
AUTH: A/KETCHEL, J. M.; B/MALONE, T. B.; C/SCHWEICKERT, G. A., JR.
CORP: Matrix Corp., Alexandria, Va. CSS: (HUMAN FACTORS DIV.) AVAIL.NTIS
MAJS: /*AIRCRAFT NOISE/*AIRCRAFT PILOTS/*HELICOPTERS/* VIBRATION EFFECTS
MINS: / COMFORT/ HUMAN FACTORS ENGINEERING/ PHYSIOLOGICAL EFFECTS/ PILOT PERFORMANCE/ PSYCHOLOGICAL EFFECTS

70N36986*# ISSUE 20 PAGE 3655 CATEGORY 1 RPT#: NASA-CR-112769 ASRL-TR-153-3 CNT#: NGR-22-009-303 70/08/00 23 PAGES UNCLASSIFIED DOCUMENT
UTTL: A comparison between experimental data and a lifting surface theory calculation of vortex induced loads
UNOC: Comparison between experimental data and lifting surface theory calculation of vortex induced loads on single-bladed rotary wings
AUTH: A/JOHNSON, W.
CORP: Massachusetts Inst. of Tech., Cambridge. CSS: (AEROELASTIC AND STRUCTURES RESEARCH LAB.) AVAIL.NTIS
MAJS: /*HELICOPTERS/*LIFT DEVICES/*ROTARY WINGS/*VORTICES
MINS: / AERODYNAMIC LOADS/ ROTOR LIFT

70N33971*# ISSUE 18 PAGE 3298 CATEGORY 5 RPT#: AD-706001 REPT-12543-FR4 JANAIR-680610 CNT#: N00014-66-C-0362 70/03/00 244 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effects of varying levels of autopilot assistance and workload on pilot performance in the helicopter formation flight mode Final technical report, Dec. 1967 - Apr. 1968
UNOC: Varying levels of autopilot assistance and workload effects on pilot performance in helicopter formation flight mode
AUTH: A/ANDERSON, P. A.; B/TOIVANEN, M. L.
CORP: Honeywell, Inc., Minneapolis, Minn. CSS: (SYSTEMS AND RESEARCH CENTER.) AVAIL.NTIS

MAJS: /*AUTOMATIC PILOTS/*FLIGHT CONTROL/*HELICOPTERS/*PILOT PERFORMANCE
MINS: / OPERATIONS RESEARCH/ STATISTICAL ANALYSIS/ TASK COMPLEXITY/ WORK

70N28119*# ISSUE 14 PAGE 2554 CATEGORY 10
RPT#: NASA-CR-86355 CNT#: NAS12-583 70/05/00 58 PAGES UNCLASSIFIED DOCUMENT
UTTL: A program for interactive computation in linear systems theory Final report
UNOC: FORTRAN 4 program for analysis and design of dynamic systems
AUTH: A/ENGLAR, T. S.
CORP: Mathematical Sciences Group, College Park, Md. AVAIL.NTIS
MAJS: /*COMPUTER PROGRAMS/*LINEAR SYSTEMS/*SYSTEMS ANALYSIS
MINS: / DECOUPLING/ DYNAMIC CONTROL/ FORTRAN/ HELICOPTER CONTROL/ MANUALS/ SYSTEMS ENGINEERING/ TIME SHARING

70N27323*# ISSUE 13 PAGE 2319 CATEGORY 1 RPT#: NASA-TT-F-12952 CNT#: NASW-2035 70/05/00 19 PAGES UNCLASSIFIED DOCUMENT
UTTL: Representation of a lifting line in an arbitrary motion by a line of acceleration doublets
UNOC: Lifting line theory in arbitrary motion applied to design of helicopter blades
AUTH: A/DAT, R.
CORP: Scientific Translation Service, Santa Barbara, Calif. AVAIL.NTIS
WASHINGTON NASA TRANSL. INTO ENGLISH FROM RECH. AEROSPATIALE /FRENCH/, NO. 133, NOV.-DEC. 1969 P 45-51
MAJS: /*AERODYNAMIC CONFIGURATIONS/*HELICOPTER DESIGN/*LIFTING BODIES/*ROTARY WINGS
MINS: / LIFT DEVICES/ SURFACES

70N24450*# ISSUE 11 PAGE 1955 CATEGORY 1 RPT#: NASA-CR-66916 CNT#: NGR-39-009-111 70/03/00 68 PAGES UNCLASSIFIED DOCUMENT
UTTL: Effect of wing tip configuration on the strength and position of a rolled-up vortex
UNOC: Effect of wing tip configuration on strength and position of rolled-up vortex
AUTH: A/PADAKANNAYA, R. PAN: (AA/M.S. THESIS/)
CORP: Pennsylvania State Univ., University Park. CSS: (DEPT. OF AEROSPACE ENGINEERING.) AVAIL.NTIS
MAJS: /*AIRFOIL PROFILES/*VORTICES/*WING TIPS
MINS: / HELICOPTER WAKES/ MATHEMATICAL MODELS/ ROTARY WINGS/ ROTOR AERODYNAMICS/ WIND TUNNEL MODELS

70N21823*# ISSUE 9 PAGE 1585 CATEGORY 5 RPT#: NASA-TT-F-12876 CNT#: NASW-2037 70/03/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Thermal comfort while wearing aviation helmets, especially in helicopters
UNOC: Comparison of heat development inside white and green aviation helmets worn by helicopter pilots
AUTH: A/VAN DER VALK, N. J. L.
CORP: Techtran Corp., Glen Burnie, Md. AVAIL.NTIS
WASHINGTON NASA TRANSL. INTO ENGLISH FROM INST. ZINTUIGSFYSIOLOGIE RVO-TNO REPT. 12F, 1968-1969 9 P
MAJS: /*FLIGHT CLOTHING/*HELICOPTERS/*TEMPERATURE MEASUREMENT/*THERMAL COMFORT
MINS: / HELMETS

PRINT 23/2/2 09-2238 TERMINAL=20

82A26620* ISSUE 11 PAGE 1754 CATEGORY 37 CNT#: NSG-1592 81/11/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter vibration suppression using simple pendulum absorbers on the rotor blade

AUTH: A/HAMOUDA, M.-N. H.; B/PIERCE, G. A. PAA: B/(Georgia Institute of Technology, Atlanta, GA)

CORP: Georgia Inst. of Tech., Atlanta.
American Helicopter Society, National Specialists Meeting on Helicopter Vibration, Hartford, CT, Nov. 2-4, 1981, Paper. 15 p.

MAJS: /*AERODYNAMIC LOADS/*HELICOPTER DESIGN/*PENDULUMS/*ROTARY WINGS/*VIBRATION DAMPING/*VIBRATION ISOLATORS

MINS: / DEGREES OF FREEDOM/ FREQUENCY RESPONSE/ HARMONIC ANALYSIS/ HUBS/ MATRICES (MATHEMATICS)/ ROTOR AERODYNAMICS/ WING LOADING

ABA: C.R.

ABS: A design procedure is presented for the installation of simple pendulums on the blades of a helicopter rotor to suppress the root reactions. The procedure consists of a frequency response analysis for a hingeless rotor blade excited by a harmonic variation of spanwise airload distributions during forward flight, as well as a concentrated load at the tip. The structural modeling of the blade provides for elastic degrees of freedom in flap and lead-lag bending plus torsion. Simple flap and lead-lag pendulums are considered individually. Using a rational order scheme, the general nonlinear equations of motion are linearized. A quasi-steady aerodynamic representation is used in the formation of the airloads. The solution of the system equations derives from their representation as a transfer matrix. The results include the effect of pendulum tuning on the minimization of the hub reactions.

82A17661*# ISSUE 6 PAGE 814 CATEGORY 8 RPT#: AIAA PAPER 82-0242 CNT#: NAS2-10777 82/01/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Dynamic stability of a buoyant quad-rotor aircraft --- for airlifting payloads externally on a sling

AUTH: A/NAGABHUSHAN, B. L.; B/TOMLINSON, N. P. PAA: B/(Goodyear Aerospace Corp., Defense Systems Div., Akron, OH)

CORP: Goodyear Aerospace Corp., Akron, Ohio.
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 20th, Orlando, FL, Jan. 11-14, 1982, 10 p.

MAJS: /*AERODYNAMIC STABILITY/*FLIGHT SIMULATION/*HOVERING STABILITY/*ROTORCRAFT AIRCRAFT

MINS: / AERODYNAMIC LOADS/ AIRCRAFT CONFIGURATIONS/ CIVIL AVIATION/ LINEAR SYSTEMS/ MATHEMATICAL MODELS/ MILITARY AIRCRAFT/ NONLINEAR SYSTEMS/ PERFORMANCE PREDICTION/ VERTICAL LANDING/ VERTICAL TAKEOFF

ABA: (Author)

ABS: Stability characteristics of a buoyant quad-rotor aircraft (BQRA) in hover and forward flight are examined by considering linear, state-variable, and nonlinear flight simulation models of such a configuration. The effects of carrying a sling load on the vehicle dynamics is predicted by considering a coupled model of the two bodies. Inherent stability characteristics of the vehicle are analyzed and compared with those of a helicopter and an airship in free flight. Typical operational conditions that could lead to vehicle instability are described in the flight envelope of interest.

82A10455*# ISSUE 1 PAGE 130 CATEGORY 71 RPT#: AIAA PAPER 81-2001 CNT#: NAS1-15730 81/10/00 26 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter rotor trailing edge noise

AUTH: A/SCHLINKER, R. H.; B/AMIET, R. K. PAA: B/(United Technologies Research Center, East Hartford, CT)

CORP: United Technologies Research Center, East Hartford, Conn.
American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 7th, Palo Alto, CA, Oct. 5-7, 1981. 26 p.

MAJS: /*AEROACOUSTICS/*AERODYNAMIC NOISE/*HELICOPTER PERFORMANCE/*NOISE PREDICTION (AIRCRAFT)/*ROTARY WINGS/*TRAILING EDGES

MINS: / NOISE SPECTRA/ REYNOLDS NUMBER/ SCALING LAWS/ WIND TUNNEL TESTS

ABA: (Author)

ABS: An experimental and theoretical study was conducted to assess the importance of trailing edge noise as a helicopter main rotor broadband noise source. The noise mechanism was isolated by testing a rotor blade segment in an open jet acoustic wind tunnel at close to full scale Reynolds numbers. Boundary layer data and acoustic data were used to develop scaling laws and assess a first principles trailing edge noise theory. Conclusions from the isolated blade study were analytically transformed to the rotating frame coordinate system to develop a generalized rotor noise prediction. Trailing edge noise was found to contribute significantly to the total helicopter noise spectrum at high frequencies.

81A48615*# ISSUE 24 PAGE 4127 CATEGORY 7 RPT#: AIAA PAPER 81-2003 CNT#: NSG-1583 81/10/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Tip geometry effects on the model helicopter rotor low frequency broadband noise

AUTH: A/HUMPHEAD, N. G.; B/HARRIS, W. L. PAA: B/(MIT, Cambridge, MA)

CORP: Massachusetts Inst. of Tech., Cambridge. American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 7th, Palo Alto, CA, Oct. 5-7, 1981, 14 p.

MAJS: /*AIRCRAFT NOISE/*BLADE TIPS/*HELICOPTERS/*NOISE REDUCTION/*ROTARY WINGS

MINS: / AERODYNAMIC LOADS/ BROADBAND/ LIFT/ LOW FREQUENCIES/ NOISE SPECTRA/ SOUND PRESSURE/ TURBULENCE EFFECTS

ABA: C.R.

ABS: The effect of rotor blade tip shapes and performance parameters on the low frequency broadband noise (LFBN) is investigated experimentally. The experimental results show 2 to 5 dB reductions for swept geometries compared with square tip blades at constant blade loading. A theoretical model is formulated which includes a detailed lift response function. For the square tip blades, theoretical results are found to be in good agreement with the experimental results. While the effects of advance ratio and tip speed on the LFBN are explicable, those of blade loading are not clearly understood.

81A46610*# ISSUE 22 PAGE 3812 CATEGORY 5 81/00/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: An ABC status report --- Advancing Blade Concept for XH-59A rotors

AUTH: A/LINDEN, A. W.; B/RUDDELL, A. J. PAA: B/(United Technologies Corp., Sikorsky Aircraft Div., Stratford, CT)

CORP: Sikorsky Aircraft, Stratford, Conn. In: American Helicopter Society, Annual Forum, 37th, New Orleans, LA, May 17-20, 1981, Proceedings. (A81-46603 22-01) Washington, DC, American Helicopter Society, 1981, p. 72-87. Army-Navy-NASA-supported research.

MAJS: /*AERODYNAMIC CHARACTERISTICS/*COMPOUND HELICOPTERS/*HELICOPTER DESIGN/*MILITARY HELICOPTERS/*RIGID ROTOR HELICOPTERS/*ROTARY WINGS

MINS: / AIRSPEED/ COUNTER ROTATION/ LIFT/ STRUCTURAL VIBRATION/ TECHNOLOGY ASSESSMENT

ABA: G.R.

ABS: The Advancing Blade Concept (ABC) uses two rigid counterrotating rotors in a coaxial arrangement to provide advancing blades on both sides of the aircraft. This makes use of the high dynamic pressure on the advancing side of the rotors at high forward speed, virtually ignoring the low dynamic pressure on the retreating side, while still keeping the rotor system in roll trim. Theoretically such a rotor system will maintain its lift potential as speed increases. The XH-59A was designed to investigate this theory. A description is provided of the flight test program from May, 1980 to January, 1981. A summary is presented of the knowledge gained throughout the entire program, and current pitfalls are reviewed. It is concluded that the ABC has been verified, with the XH-59A envelope of blade lift coefficient as a function of advance ratio greatly exceeding that of conventional helicopter rotor systems.

81A43644* ISSUE 20 PAGE 3465 CATEGORY 5 80/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: A low-cost forward fairing for the Bell Long Ranger Helicopter

AUTH: A/ZINBERG, H. PAA: A/(Bell Helicopter Textron, Fort Worth, TX)

CORP: Textron Bell Helicopter, Fort Worth, Tex. In: Materials 1980; Proceedings of the Twelfth National Technical Conference, Seattle, WA, October 7-9, 1980. (A81-43601 20-23) Azusa, CA, Society for the Advancement of Material and Process Engineering, 1980, p. 678-687. NASA-Army-sponsored research.

MAJS: /*AIRCRAFT CONSTRUCTION MATERIALS/*COMMERCIAL AIRCRAFT/*COMPOSITE MATERIALS/*FAIRINGS/*HELICOPTER DESIGN/*MATERIALS TESTS

MINS: / AIRCRAFT STRUCTURES/ COST REDUCTION/ SERVICE LIFE/ STRUCTURAL DESIGN

ABA: G.R.

ABS: A description is presented of work concerned with determining the effects of long-term flight service on advanced composite helicopter airframe components. The helicopter chosen for the program is the Long Ranger Model 206L. The components to be evaluated include the baggage door, litter door, vertical fin, and forward fairing. Only the vertical fin is classified as primary structure. Loss of any of the other components will not compromise safety of the aircraft. Attention is given to the program objectives, the design of the forward fairing, the fabrication procedures, the exterior surface, the cocure procedure, material tests, and initial cost-tracking. The considered program demonstrates the ability to produce an acceptable fairing by the 'one-shot' cocured process, and, based on learning curve experience, production costs will be low. The low-temperature 200 F cure does not affect the structural properties to an unacceptable degree. A method for obtaining a smooth, exterior painted surface for Kevlar/epoxy fabric has been developed.

81A40189* ISSUE 18 PAGE 3085 CATEGORY 8 RPT#: AHS 80-71 CNT#: NAS2-101211 80/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: An active control system for helicopter vibration reduction by higher harmonic pitch

AUTH: A/TAYLOR, R. B.; B/FARRAR, F. A.; C/MIAO, W. PAA: B/(United Technologies Research Center, East Hartford, CT); C/(United Technologies Corp., Sikorsky Aircraft Div., Stratford, CT)

CORP: United Technologies Research Center, East Hartford, Conn.; Sikorsky Aircraft, Stratford, Conn.

In: American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings. (A81-40136 18-01) Washington, DC, American Helicopter Society, 1980, 12 p.

MAJS: /*ACTIVE CONTROL/*HELICOPTER CONTROL/*PITCH (INCLINATION)/*REAL TIME OPERATION/*ROTARY WINGS/*VIBRATION DAMPING

MINS: / ACCELEROMETERS/ ALGORITHMS/ COMPUTERIZED SIMULATION/ FEEDBACK CONTROL/ FLIGHT CONDITIONS/ HELICOPTER PERFORMANCE

ABA: E.B.

ABS: An analytical study defining the basic configuration of an active control system to reduce helicopter vibrations is presented. Theoretical results for a nonlinear four-bladed single rotor helicopter simulation are discussed, showing that vibration reductions on the order of 80-90% for airspeeds up to 150 kn can be expected when using a higher harmonic pitch in an active feedback control system. The rotor performance penalty associated with this level of vibration reduction is about 1-3% and the increase in rotor blade stresses is considered to be low. The location of sensor accelerometers proved to be significant for vibration reductions, and it is noted that the RTSA controller is tolerant of sensor signal noise.

81A40184* ISSUE 18 PAGE 3204 CATEGORY 71 RPT#: AHS 80-60 80/00/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Trailing edge noise from hovering rotors

AUTH: A/KIM, Y. N.; B/GEORGE, A. R. PAA: B/(Cornell University, Ithaca, NY)

CORP: Cornell Univ., Ithaca, N. Y.

In: American Helicopter Society, Annual Forum, 36th, Washington, DC, May 13-15, 1980, Proceedings. (A81-40136 18-01) Washington, DC, American Helicopter Society, 1980, 14 p. Army-NASA-supported research.

MAJS: /*ATMOSPHERIC TURBULENCE/*ENGINE NOISE/*HELICOPTERS/*HOVERING STABILITY/*NOISE PREDICTION (AIRCRAFT)/*ROTARY WINGS/*TRAILING EDGES

MINS: / AERODYNAMIC STALLING/ AIRFOILS/ BLADE TIPS/ COMPUTATIONAL FLUID DYNAMICS/ HIGH FREQUENCIES/ NOISE SPECTRA/ TURBULENCE EFFECTS/ TURBULENT BOUNDARY LAYER/ VORTICES

ABA: (Author)

ABS: A method has been developed to predict the high frequency broadband noise due to the interaction of convecting turbulent eddies with the trailing edges of a hovering rotor. The trailing edge noise from each blade was modeled as point dipole noise with spanwise loading corrections. This point dipole approximation was checked by applying the concept to a stationary airfoil in a moving medium with excellent results. In order to estimate the strength of the point dipole, the trailing edge noise theory of Amiet was used. The method was applied specifically to blade boundary layer turbulence and compared to incident atmospheric turbulence noise. The results indicate that the relative importance of these two mechanisms is related to the magnitudes of the intensity and of the length scales of the inflow and boundary layer turbulence. The results tend to fall below some available experimental data indicating that in those experiments other broadband noise sources were stronger than boundary layer-trailing edge noise. The approach which was developed is also applicable to other blade-turbulence interaction mechanisms such as local stall and tip noise.

81A40089* ISSUE 18 PAGE 3072 CATEGORY 5 CNT#: NSG-1578 80/00/00 35 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotor blade aeroelastic stability and response in forward flight

AUTH: A/FRIEDMANN, P. P.; B/KOTTAPALLI, S. B. R. PAA: B/(California, University, Los Angeles, CA)

CORP: California Univ., Los Angeles.

In: European Rotorcraft and Powered Lift Aircraft Forum, 6th, Bristol, England, September 16-19, 1980, Conference Papers. Part 1. (A81-40076 18-01) Bristol, University of Bristol, 1980. 35 p. Army-supported research;

MAJS: /*AERODYNAMIC BALANCE/*AEROELASTICITY/*FLIGHT CHARACTERISTICS/*RIGID ROTORS/*ROTOR AERODYNAMICS/*STRUCTURAL STABILITY

MINS: / EQUATIONS OF MOTION/ GALERKIN METHOD/ HELICOPTER PERFORMANCE/ STRUCTURAL VIBRATION/ TORSIONAL STRESS/ WIND TUNNEL TESTS

ABA: (Author)

ABS: The aeroelastic stability and response problem of the coupled flap-lag-torsional dynamics of a hingeless rotor blade in forward flight is treated in a comprehensive manner. The spatial dependence of the partial differential, nonlinear, equations of motion is discretized using a multimodal Galerkin method. The aeroelastic problem is coupled with the trim state of

the helicopter obtained from improved, representative, trim procedures. The nonlinear time dependent equilibrium position, or response, about which the equations are linearized is obtained by solving a sequence of linear periodic response problems, using quasi-linearization. Numerous results illustrating blade behavior in forward flight are presented.

81A36561*# ISSUE 16 PAGE 2803 CATEGORY 53
RPT#: AIAA 81-0972 CNT#: NAS2-10145 81/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Pilot/vehicle model analysis of visual and motion cue requirements in flight simulation

AUTH: A/LANCRAFT, R.; B/ZACHARIAS, G.; C/BARON, S. PAA: C/(Bolt Beranek and Newman, Inc., Cambridge, Mass.)

CORP: Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

In: Flight Simulation Technologies Conference, Long Beach, Calif., June 16-18, 1981, Technical Papers. (A81-36554 16-09) New York, American Institute of Aeronautics and Astronautics, Inc., 1981, p. 49-59.

MAJS: /*FLIGHT SIMULATION/*HELICOPTER CONTROL/*HOVERING/*MAN MACHINE SYSTEMS/*OPTIMAL CONTROL/*PILOT PERFORMANCE/* TRAINING ANALYSIS

MINS: / CONTROL SIMULATION/ CUES/ MOTION PERCEPTION/ PERFORMANCE PREDICTION/ SYSTEMS SIMULATION/ VISUAL SIGNALS/ WORKLOADS (PSYCHOPHYSIOLOGY)

ABA: (Author)

ABS: The optimal control model for pilot/vehicle analysis is used to explore the effects of a CGI visual system and motion system dynamics on helicopter hover simulation fidelity. This is accomplished by expanding the perceptual aspects of the model to include motion sensing and by relating CGI parameters to information processing parameters of the model. Simulator fidelity is examined by comparing predicted performance and workload for flight with that predicted for various simulator configuration. The results of the analysis suggest that simulator deficiencies or a reasonable nature (by current standards) can result in substantial performance and/or workload infidelity. Both CGI and motion system effects are significant for this task. There is also a distinct interaction between the two sources of pilot cues. In particular, the presence of motion reduces the sensitivity to CGI limitations.

81A34221* ISSUE 15 PAGE 2475 CATEGORY 1 RPT#: SAE PAPER 801213 CNT#: NAS1-13479 80/10/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Design, fabrication and test of a complex helicopter airframe section

AUTH: A/RICH, M. J. PAA: A/(United Technologies Corp., Sikorsky Aircraft Div., Stratford, Conn.)

CORP: United Technologies Corp., Stratford, Conn.

Society of Automotive Engineers, Aerospace Congress and Exposition, Los Angeles, Calif., Oct. 13-16, 1980. 10 p. Army-sponsored research:

MAJS: /*AIRCRAFT CONSTRUCTION MATERIALS/*AIRCRAFT PRODUCTION /*AIRFRAME MATERIALS/*GRAPHITE-EPOXY COMPOSITES/* HELICOPTER DESIGN

MINS: / ADHESIVE BONDING/ BUCKLING/ FABRICATION/ FASTENERS/ LOAD TESTS/ LOW COST/ ROOFS/ SHEAR STRESS/ SKIN (STRUCTURAL MEMBER)/ STIFFENING/ WEIGHT REDUCTION

ABA: O.C.

ABS: A design solution is developed for the fabrication of an all-composite helicopter airframe cabin roof structure. Although this is inherently a complex structure, the parts count has been minimized by the avoidance of many mechanical fasteners, and a weight reduction of 26% has been obtained. The reduction of parts and elimination of mechanical fasteners will also result in a lowering of labor costs. The bonded graphite/epoxy elements of the structure employed aluminum tooling with control on all mating surfaces to yield accurate bond lines. A summary of static test results is presented for the basic structure and for the structure with mechanically fastened skin stiffeners. It is shown that the shear buckles caused the skin to peel from the stiffeners at about 960 lb/in. shear flow, calling for the addition of stiffeners with more bond area.

81A30107*# ISSUE 12 PAGE 2006 CATEGORY 37
RPT#: ASME PAPER 81-GT-219 CNT#: EF-76-5-2479
DAAG29-77-C-0009 NSG-3105 81/03/00 9 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Unbalance response of a two spool gas turbine engine with squeeze film bearings

AUTH: A/GUNTER, E. J.; B/BARRETT, L. E.; C/LI, D. F. PAA: B/(Virginia, University, Charlottesville, Va.); C/(GM Research Laboratories, Warren, Mich.)

CORP: Virginia Univ., Charlottesville.; General Motors Research Labs., Warren, Mich. SAP: MEMBERS, $2.00; NONMEMBERS, $4.00

American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, Houston, Tex., Mar. 9-12, 1981, 9 p.

MAJS: /*DYNAMIC LOADS/*GAS TURBINE ENGINES/*HELICOPTER ENGINES/*ROLLER BEARINGS/*SHAFTS (MACHINE ELEMENTS)/* SQUEEZE FILMS

MINS: / ENGINE DESIGN/ POWER EFFICIENCY/ ROTOR SPEED/ SPOOLS

ABA: (Author)

ABS: This paper presents a dynamic analysis of a two-spool gas turbine helicopter engine incorporating intershaft rolling element bearings between the gas generator and

power turbine rotors. The analysis includes the nonlinear effects of a squeeze film bearing incorporated on the gas generator rotor. The analysis includes critical speeds and forced response of the system and indicates that substantial dynamic loads may be imposed on the intershaft bearings and main bearing supports with an improperly designed squeeze film bearing. A comparison of theoretical and experimental gas generator rotor response is presented illustrating the nonlinear characteristics of the squeeze film bearing. It was found that large intershaft bearing forces may occur even though the engine is not operating at a resonant condition.

81A29513*# ISSUE 12 PAGE 2024 CATEGORY 39
RPT#: AIAA 81-0615 CNT#: NCC2-13 81/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Dynamic stability of a rotor blade using finite element analysis

AUTH: A/SIVANERI, N. T.; B/CHOPRA, I. PAA: B/(NASA; Stanford Joint Institute for Aeronautics and Acoustics; Stanford University, Stanford, Calif.)

CORP: Stanford Univ., Calif.

In: Structures, Structural Dynamics and Materials Conference, 22nd, Atlanta, Ga., April 6-8, 1981, and AIAA Dynamics Specialists Conference, Atlanta, Ga., April 9, 10, 1981, Technical Papers. Part 2. (A81-29428 12-01) New York, American Institute of Aeronautics and Astronautics, Inc., 1981, p. 832-843.

MAJS: /*AERODYNAMIC LOADS/*AERODYNAMIC STABILITY/*FINITE ELEMENT METHOD/*HELICOPTER DESIGN/*ROTOR BLADES

MINS: / AEROELASTICITY/ AIRFOIL PROFILES/ DEGREES OF FREEDOM / EIGENVALUES/ FLUTTER ANALYSIS/ NONLINEAR EQUATIONS/ PERTURBATION THEORY/ PROPELLER BLADES/ ROTARY WINGS

ABA: (Author)

ABS: The aeroelastic stability of flap bending, lead-lag bending, and torsion of a helicopter rotor blade in hover is examined using a finite element formulation based on the principle of virtual work. Quasi-steady two-dimensional airfoil theory is used to obtain the aerodynamic loads. The rotor blade is discretized into beam elements, each with ten modal degrees of freedom. The resulting nonlinear equations of motion are solved for steady-state blade deflections through an iterative procedure. The flutter solution is calculated assuming blade motion to be a small perturbation about the steady solution. The normal mode method based on the coupled rotating natural modes about the steady deflections is used to reduce the number of equations in the flutter eigenanalysis. Results are presented for hingeless and articulated rotor blade configurations.

B1A20061*# ISSUE 7 PAGE 1087 CATEGORY 37
80/00/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Gear meshing action as a source of vibratory excitation

AUTH: A/MARK, W. D.; B/FISCHER, R. W. PAA: B/(Bolt Beranek and Newman, Inc., Cambridge, Mass.)

CORP: Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

In: Symposium on Internal Noise in Helicopters, Southampton, England, July 17-20, 1979, Proceedings. (A81-20051 07-71) Southampton, England, University of Southampton, 1980, p. C2 1-C2 13. NASA-supported research.

MAJS: /*AIRCRAFT STABILITY/*GEAR TEETH/*HELICOPTER PROPELLER DRIVE/*STRUCTURAL VIBRATION/*TRANSMISSIONS (MACHINE ELEMENTS)

MINS: / AMPLITUDES/ ERROR ANALYSIS/ HARMONIC OSCILLATION/ MEAN SQUARE VALUES/ TRANSFER FUNCTIONS

80A52645*# ISSUE 24 PAGE 4315 CATEGORY 2 CNT#: NSG-2142 80/10/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Effect of tip vortex structure on helicopter noise due to blade-vortex interaction

AUTH: A/WIDNALL, S. E.; B/WOLF, T. L. PAA: B/(MIT, Cambridge, Mass.)

CORP: Massachusetts Inst. of Tech., Cambridge.

Journal of Aircraft, vol. 17, Oct. 1980, p. 705-711.

MAJS: /*AIRCRAFT NOISE/*LIFTING ROTORS/*RIGID ROTOR HELICOPTERS/*ROTOR AERODYNAMICS/*ROTOR BLADES/*WING TIP VORTICES

MINS: / ACOUSTIC EMISSION/ HELICOPTER WAKES/ LINEAR EQUATIONS/ SOUND PRESSURE/ UNSTEADY FLOW/ VELOCITY DISTRIBUTION

ABA: (Author)

ABS: A potential cause of helicopter impulsive noise, commonly called blade slap, is the unsteady lift fluctuation on a rotor blade due to interaction with the vortex trailed from another blade. The relationship between vortex structure and the intensity of the acoustic signal is investigated. Unsteady lift on the blades due to blade-vortex interaction is calculated using linear unsteady aerodynamic theory, and expressions are derived for the directivity, frequency spectrum, and transient signal of the radiated noise. The inviscid rollup model of Betz is used to calculate the velocity profile in the trailing vortex from the spanwise distribution of blade tip loading. A few cases of tip loading are investigated, and numerical results are presented for the unsteady lift and acoustic signal due to blade-vortex interaction. The intensity of the acoustic signal is shown to be quite sensitive to changes in tip vortex structures.

80A45523*# ISSUE 19 PAGE 3457 CATEGORY 8 RPT#: AIAA 80-1721 CNT#: NCA2-OR-130-801 80/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: A model for helicopter guidance on spiral trajectories

AUTH: A/MENDENHALL, S.; B/SLATER, G. L. PAA: A/(General Electric Co., Cincinnati, Ohio); B/(Cincinnati, University, Cincinnati, Ohio)

CORP: General Electric Co., Cincinnati, Ohio.; Cincinnati Univ., Ohio.

In: Guidance and Control Conference, Danvers, Mass., August 11-13, 1980, Collection of Technical Papers. (A80-45514 19-17) New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 62-71.

MAJS: /*AIRCRAFT GUIDANCE/*FEEDBACK CONTROL/*HELICOPTER CONTROL/*MATHEMATICAL MODELS/*STATE VECTORS/*TURNING FLIGHT

MINS: / EQUATIONS OF MOTION/ FLIGHT TIME/ SPIRALS/ V/STOL AIRCRAFT/ WIND EFFECTS

ABA: (Author)

ABS: A point mass model is developed for helicopter guidance on spiral trajectories. A fully coupled set of state equations is developed and perturbation equations suitable for 3-D and 4-D guidance are derived and shown to be amenable to conventional state variable feedback methods. Control variables are chosen to be the magnitude and orientation of the net rotor thrust. Using these variables reference controls for nonlevel accelerating trajectories are easily determined. The effects of constant wind are shown to require significant feedforward correction to some of the reference controls and to the time. Although not easily measured themselves, the controls variables chosen are shown to be easily related to the physical variables available in the cockpit.

80A35971*# ISSUE 14 PAGE 2608 CATEGORY 71 RPT#: AIAA PAPER 80-1013 CNT#: NSG-1583 80/06/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Model rotor low frequency broadband noise at moderate tip speeds

AUTH: A/HUMBAD, N. G.; B/HARRIS, W. L. PAA: B/(MIT, Cambridge, Mass.)

CORP: Massachusetts Inst. of Tech., Cambridge. American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 6th, Hartford, Conn., June 4-6, 1980. 11 p.

MAJS: /*AEROACOUSTICS/*AERODYNAMIC NOISE/*HELICOPTER PERFORMANCE/*NOISE PREDICTION (AIRCRAFT)/*ROTARY WINGS/*TIP SPEED

MINS: / BROADBAND/ LOW FREQUENCIES/ SCALING LAWS/ SOUND PRESSURE

ABA: (Author)

ABS: The results of an experimental investigation of low frequency broadband noise (LFBN) radiated from model helicopter rotors are presented. The results are for a range of tip Mach numbers (Mt) up to 0.50. The effect of rotor blade loading, advance ratio, tip speed, number of blades and free stream turbulence on the sound pressure level (SPL) and the spectrum of LFBN have been investigated. The peak SPL of LFBN appears to follow an M(4) law if the effect of rms turbulence velocity is removed. The peak SPL of LFBN seems to saturate with increases in advance ratio and with blade loading, and is proportional to the square of the turbulence integral scale when the effect of rms turbulence velocity and Mt are removed. Also, a simple peak SPL scaling law for noise from a helicopter rotor in forward flight due to convected sinusoidal gust is developed. The trend predicted by this scaling law is found to be satisfactory for the variation of the peak SPL of LFBN with tip speed.

80A35100*# ISSUE 14 PAGE 2499 CATEGORY 8 RPT#: AIAA 80-0668 AHS PAPER 80-67 CNT#: NAS1-14552 80/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Practical design considerations for a flightworthy higher harmonic control system --- for flight testing on OH-6A helicopter

AUTH: A/WOOD, E. R.; B/POWERS, R. W. PAA: B/(Hughes Helicopters, Culver City, Calif.)

CORP: Hughes Helicopters, Culver City, Calif.

In: Structures, Structural Dynamics, and Materials Conference, 21st, Seattle, Wash., May 12-14, 1980, Technical Papers, Part 2. (A80-34993 14-39) New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 978-986.

MAJS: /*ELECTRONIC CONTROL/*FLIGHT TESTS/*HARMONIC OSCILLATION/*HELICOPTER CONTROL/*OH-6 HELICOPTER/*PITCH (INCLINATION)

MINS: / AIRBORNE/SPACEBORNE COMPUTERS/ COMPUTER PROGRAMS/ FAST FOURIER TRANSFORMATIONS/ HELICOPTER DESIGN/ PROTOTYPES/ VIBRATION DAMPING/ WEIGHT ANALYSIS

ABA: A.T.

ABS: The paper discusses the design of a higher harmonic blade pitch control system for flight testing on an OH-6A helicopter. Alternative designs for both the mechanical and electronic subsystems are also presented. Among the recommendations set forth are: (1) use electronic analog methods instead of FFT software, delegating spectral analysis and self testing to an Electronic Control Unit; (2) use a digital rather than analog computer for increased flexibility in solution processing; and (3) locate HHC actuators in the nonrotating system and separate these actuators from the primary control system. It is concluded that a target weight for a prototype control

system would be less than 1% of design gross weight and the production weight of the future HHC system may be 0.5 of the weight of the aircraft.

80A34995*# ISSUE 14 PAGE 2497 CATEGORY 8 RPT#: AIAA 80-0666 AHS PAPER 80-65 80/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: A simple system for helicopter individual-blade-control and its application to gust alleviation

AUTH: A/HAM, N. D. PAA: A/(MIT, Cambridge, Mass.)

CORP: Massachusetts Inst. of Tech., Cambridge.

In: Structures, Structural Dynamics, and Materials Conference, 21st, Seattle, Wash., May 12-14, 1980. Technical Papers. Part 1. (A80-34993 14-39) New York, American Institute of Aeronautics and Astronautics, Inc., 1980, p. 57-68. NASA-sponsored research.

MAJS: /*GUST ALLEVIATORS/*HELICOPTER CONTROL/*HELICOPTER TAIL ROTORS/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / ACCELEROMETERS/ AIRCRAFT RELIABILITY/ ROTOR SPEED/ STRUCTURAL DESIGN/ STRUCTURAL VIBRATION

ABA: (Author)

ABS: A new, advanced type of active control for helicopters and its application to gust alleviation is described. Each blade is individually controlled in the rotating frame over a wide range of frequencies up to the sixth harmonic of rotor speed. Considerable system simplification is achieved by means of modal decomposition. It is shown both analytically and experimentally that by utilizing a tip-mounted accelerometer as a sensor in the feedback path, significant reductions in blade flapping response to a sinusoidal gust can be achieved at the gust excitation frequency as well as at super- and subharmonics of rotor speed.

80A12729*# ISSUE 2 PAGE 272 CATEGORY 63 CNT#: NSG-1519 79/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: A new spectral synthesis procedure for multivariable regulators

AUTH: A/MAYNARD, R. A.; B/MIELKE, R. R.; C/LIBERTY, S. R.; D/SRINATHKUMAR, S. PAA: D/(Old Dominion University, Norfolk, Va.)

CORP: Old Dominion Univ., Norfolk, Va.

In: Annual Allerton Conference on Communication, Control and Computing, 16th, Monticello, Ill., October 4-6, 1978. Proceedings. (A80-12690 02-63) Urbana, Ill., University of Illinois, 1978, p. 754-761.

MAJS: /*EIGENVALUES/*FEEDBACK CONTROL/*HELICOPTER CONTROL/*HOVERING STABILITY/*MATRICES (MATHEMATICS)/*REGULATORS

MINS: / DESIGN ANALYSIS/ EIGENVECTORS/ ITERATIVE SOLUTION/ STATE VECTORS

ABA: (Author)

ABS: A method for selecting a multivariable state feedback controller that simultaneously achieves an a priori specification on closed loop eigenvalues and good mode mixing is presented. The problem is solved by projecting a desired modal matrix onto a constraint set containing the null space of the closed-loop state matrix, while assuring that the projection is in the null space. The feedback matrix follows immediately in the formulation. An example involving a helicopter hover controller is presented.

79A47841* ISSUE 21 PAGE 4036 CATEGORY 71 CNT#: DAAG29-C-027 NSG-2095 79/08/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Low-frequency broadband noise generated by a model rotor

AUTH: A/ARAVAMUDAN, K. S.; B/HARRIS, W. L. PAA: B/(MIT, Cambridge, Mass.)

CORP: Massachusetts Inst. of Tech., Cambridge.

Acoustical Society of America, Journal, vol. 66, Aug. 1979, p. 522-533.

MAJS: /*AERODYNAMIC NOISE/*ANECHOIC CHAMBERS/*LOW FREQUENCY BANDS/*NOISE SPECTRA/*PROPELLER BLADES/*ROTOR AERODYNAMICS

MINS: / HELICOPTERS/ NOISE MEASUREMENT/ ROTARY WINGS/ TURBULENT FLOW/ WIND TUNNEL MODELS/ WIND TUNNEL TESTS

ABA: (Author)

ABS: Low-frequency broadband noise generated by model rotors is attributed to the interaction of ingested turbulence with the rotor blades. The influence of free-stream turbulence in the low-frequency broadband noise radiation from model rotors has been experimentally investigated. The turbulence was generated in the M.I.T. anechoic wind tunnel facility with the aid of bipolar grids of various sizes. The spectra and the intensity of the low-frequency broadband noise have been studied as a function of parameters which characterize the turbulence and of helicopter performance parameters. The location of the peak intensity was observed to be strongly dependent on the rotor-tip velocity and on the longitudinal integral scale of turbulence. The size scale of turbulence had negligible effect on the intensity of low-frequency broadband noise. The experimental data show good agreement with an ad hoc model based on unsteady aerodynamics.

79A29004*# ISSUE 11 PAGE 2045 CATEGORY 39
RPT#: AIAA 79-0730 CNT#: NSG-1370 79/00/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Vibration analysis of rotor blades with pendulum absorbers

AUTH: A/MURTHY, V. R.; B/HAMMOND, C. E. PAA: A/(Goodyear Aerospace Corp., Akron, Ohio); B/(U.S. Army, Structures Laboratory, Hampton, Va.)

CORP: Goodyear Aerospace Corp., Akron, Ohio.; Army Structures Lab., Hampton, Va.

In: Structures, Structural Dynamics, and Materials Conference, 20th, St. Louis, Mo., April 4-6, 1979, Technical Papers on Structures and Materials. (A79-29002 11-39) New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 13-28.

MAJS: /*PENDULUMS/*ROTARY WINGS/*ROTOR BLADES/*VIBRATION DAMPING/*VIBRATION ISOLATORS

MINS: / COUPLED MODES/ EQUATIONS OF MOTION/ HELICOPTERS/ MATRICES (MATHEMATICS)/ RESONANT FREQUENCIES/ VIBRATION MODE

ABA: P.T.H.

ABS: A comprehensive vibration analysis of rotor blades with spherical pendulum absorbers is presented. Linearized equations of motion for small oscillations about the steady-state deflection of a spherical pendulum on elastic rotor blades undergoing coupled flapwise bending, chordwise bending, and torsional vibrations are obtained. A transmission matrix formulation is given to determine the natural vibrational characteristics of rotor blades with spherical or simple flapping pendulum absorbers. The natural frequencies and mode shapes of a hingeless rotor blade with a spherical pendulum are computed.

79A22475* ISSUE 7 PAGE 1118 CATEGORY 5 CNT#: NAS2-7613 79/01/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Parameter identification applied to analytic hingeless rotor modeling

AUTH: A/BANERJEE, D.; B/CREWS, S. T.; C/HOHENEMSER, K. H. PAA: A/(Hughes Helicopters, Culver City, Calif.); B/(U.S. Army, Systems Development and Qualification Div., St. Louis, Mo.); C/(Washington University, St. Louis, Mo.)

CORP: Hughes Helicopters, Culver City, Calif.; Army Aviation Research and Development Command, St. Louis, Mo.; Washington Univ., St. Louis, Mo.

American Helicopter Society, Journal, vol. 24, Jan. 1979, p. 26-32. Army-sponsored research;

MAJS: /*AEROELASTICITY/*HELICOPTER PERFORMANCE/*IDENTIFYING /*MATHEMATICAL MODELS/*RIGID ROTORS/*ROTOR AERODYNAMICS

MINS: / COMPUTER TECHNIQUES/ EIGENVALUES/ PITCH (INCLINATION)/ SYSTEMS ANALYSIS/ TRANSIENT RESPONSE/ WIND TUNNEL MODELS

ABA: (Author)

ABS: It is known that dynamic rotor inflow has a substantial effect on rotor dynamic loads. Despite the complexity of the unsteady flow problem, simple analytical models can be made useful by identifying their parameters from transient response tests without performing flow measurements. Two analytical inflow models are studied: the first is based on an equivalent blade lock number, the second is based on a time delayed unsteady momentum inflow. In preparation for the experimental data analysis, identifications from simulated test data and an eigenvalue analysis are performed. The experimental results show that the first analytical inflow model is accurate for rotor advance ratios of 0.4 and above. For lower advance ratios, the second inflow model provides better accuracy. Prediction studies with experimental data not used for the identification are performed to determine the accuracy of the mathematical models.

79A18659*# ISSUE 6 PAGE 1011 CATEGORY 39 CNT#: NGR-05-007-414 78/00/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of the finite element method to rotary-wing aeroelasticity --- in helicopter hovering flight

AUTH: A/FRIEDMANN, P.; B/STRAUB, F. PAA: A/(California, University, Los Angeles, Calif.)

CORP: California Univ., Los Angeles.

In: European Rotorcraft and Powered Lift Aircraft Forum, 4th, Stresa, Italy, September 13-15, 1978, Proceedings, Volume 1. (A79-18637 06-01) Gallarate, Italy, Costruzioni Aeronautiche Giovanni Agusta S.p.A., 1978, p. 24-0 to 24-23. Army-supported research;

MAJS: /*AEROELASTICITY/*FINITE ELEMENT METHOD/*HELICOPTER PERFORMANCE/*HOVERING STABILITY/*ROTARY WINGS

MINS: / FLIGHT CHARACTERISTICS/ GALERKIN METHOD/ ROTOR AERODYNAMICS

ABA: (Author)

ABS: Recent research in rotary-wing aeroelasticity has indicated that all fundamental problems in this area are inherently nonlinear. The non-linearities in this problem are due to the inclusion of finite slopes, due to moderate deflections, in the structural, inertia and aerodynamic operators associated with this aeroelastic problem. In this paper the equations of motion, which are both time and space dependent, for the aeroelastic problem are first formulated in P.D.E. form. Next the equations are linearized about a suitable equilibrium position. The spatial dependence in these equations is discretized using a local

Galerkin method of weighted residuals resulting in a finite element formulation of the aeroelastic problem. As an illustration the method is applied to the coupled flap-lag problem of a helicopter rotor blade in hover. Comparison of the solutions with previously published solutions establishes the convergence properties of the method. It is concluded that this formulation is a practical tool for solving rotary-wing aeroelastic stability or response problems.

79A18657*# ISSUE 6 PAGE 939 CATEGORY 5 CNT#: NAS1-14522 78/00/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: On methods for application of harmonic control --- helicopter vibration reduction by blade pitch variation

AUTH: A/WOOD, E. R.; B/POWERS, R. W.; C/HAMMOND, C. E. PAA: B/(Hughes Helicopters, Culver City, Calif.); C/(U.S. Army, Research and Technology Laboratories, Hampton, Va.)

CORP: Hughes Helicopters, Culver City, Calif.; Army Research and Technology Labs., Fort Eustis, Va.
In: European Rotorcraft and Powered Lift Aircraft Forum, 4th, Stresa, Italy, September 13-15, 1978, Proceedings, Volume 1. (A79-18637 06-01) Gallarate, Italy, Costruzioni Aeronautiche Giovanni Agusta S.p.A., 1978, p. 22-0 to 22-16. Army-supported research.

MAJS: /*HARMONIC OSCILLATION/*HELICOPTER CONTROL/*HELICOPTER PROPELLER DRIVE/*VARIABLE PITCH PROPELLERS/*VIBRATION DAMPING

MINS: / AIRCRAFT MODELS/ VIBRATORY LOADS/ WIND TUNNEL TESTS

ABA: B.J.

ABS: The paper presents data which confirm the effectiveness of higher harmonic blade pitch control in substantially reducing helicopter rotor vibratory hub loads. The data are the result of recent tests on a 2.7-m model conducted in the Langley Research Center's transonic dynamics wind tunnel. Several predictive analyses developed in support of the NASA program are shown capable of accurately predicting both amplitude and phase of the higher harmonic control input required to nullify a single 4/rev force or moment input. The use of multiple blade feathering inputs in the design of a flightworthy higher harmonic control system is discussed.

79A18654*# ISSUE 6 PAGE 939 CATEGORY 5
78/00/00 24 PAGES UNCLASSIFIED DOCUMENT

UTTL: The RSRA Active Isolation/Rotor Balance System --- Rotor Systems Research Aircraft

AUTH: A/KUCZYNSKI, W. A.; B/MADDEN, J. PAA: B/(United Technologies Corp., Sikorsky Aircraft Div., Stratford, Conn.)

CORP: Sikorsky Aircraft, Stratford, Conn.
In: European Rotorcraft and Powered Lift Aircraft Forum, 4th, Stresa, Italy, September 13-15, 1978, Proceedings, Volume 1. (A79-18637 06-01) Gallarate, Italy, Costruzioni Aeronautiche Giovanni Agusta S.p.A., 1978, p. 18-1 to 18-24. NASA-Army-sponsored research.

MAJS: /*AERODYNAMIC BALANCE/*HELICOPTER PROPELLER DRIVE/*ROTOR AERODYNAMICS/*ROTOR SYSTEMS RESEARCH AIRCRAFT/*STRUCTURAL VIBRATION/*VIBRATION ISOLATORS

MINS: / AIRCRAFT STABILITY/ FLIGHT TESTS/ GROUND TESTS/ ROTARY WINGS/ SYSTEMS ENGINEERING/ TRANSMISSIONS (MACHINE ELEMENTS)

ABA: B.J.

ABS: The Rotor Systems Research Aircraft (RSRA) includes provisions for the installation of an Active Transmission Isolation/Rotor Loads Balance System (AIBS). The purpose of this system is to enable aircraft operation with an arbitrary rotor system over a wide rotor speed range and maneuver envelope without vibration envelope restrictions, while simultaneously providing measurement of rotor system loads. The present paper reviews the history of the design and development of this system, which culminated in successful flight test evaluation in 1977. Consideration is given to highlights of the design, ground test, and flight test.

79A18653*# ISSUE 6 PAGE 1011 CATEGORY 39 CNT#: NAS2-7613 78/00/00 35 PAGES UNCLASSIFIED DOCUMENT

UTTL: The role of rotor impedance in the vibration analysis of rotorcraft

AUTH: A/HOHENEMSER, K. H.; B/YIN, S.-K. PAA: A/(Washington University, St. Louis, Mo.); B/(Bell Helicopter Textron, Fort Worth, Tex.)

CORP: Washington Univ., St. Louis, Mo.; Textron Bell Helicopter, Fort Worth, Tex.
In: European Rotorcraft and Powered Lift Aircraft Forum, 4th, Stresa, Italy, September 13-15, 1978, Proceedings, Volume 1. (A79-18637 06-01) Gallarate, Italy, Costruzioni Aeronautiche Giovanni Agusta S.p.A., 1978, p. 17-0 to 17-34.

MAJS: /*AEROELASTICITY/*DYNAMIC STRUCTURAL ANALYSIS/*HELICOPTER DESIGN/*MECHANICAL IMPEDANCE/*ROTARY WING AIRCRAFT/*VIBRATION DAMPING

MINS: / AERODYNAMIC CONFIGURATIONS/ FINITE ELEMENT METHOD/

IMPEDANCE MATCHING/ MATRIX METHODS/ RIGID ROTORS/ ROTOR BLADES/ STABILITY DERIVATIVES/ TRANSFER FUNCTIONS

ABA: (Author)

ABS: In an improved method which retains the advantage of separate treatment of rotor and airframe, the rotor impedance is used to correct the input to the airframe. This improved method is illustrated for a strongly idealized case of vertical excitation and then for rolling and pitching moment excitation of a four bladed hingeless rotor on an up-focussing flexible mount. Contrary to the usual approach that represents aeroelastic blade motions by a series of normal blade modes in vacuum, the aeroelastic rotor impedances are computed directly with a finite blade element method that includes aerodynamics. The rotor impedance matrix for three or more blades is determined from the root moment impedance for a single blade by a simple multiblade transformation rule. Force and moment amplitudes transferred from the rotor to the support are found to be critically dependent on the support dynamics.

79A18171* ISSUE 5 PAGE 756 CATEGORY 7 RPT#: AHS 78-48 CNT#: NAS2-6505 NAS2-6598 78/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Definition and analytical evaluation of a power management system for tilt-rotor aircraft

AUTH: A/MORRIS, J. J.; B/ALEXANDER, H. R. PAA: B/(Boeing Vertol Co., Philadelphia, Pa.)

CORP: Boeing Vertol Co., Philadelphia, Pa.

In: American Helicopter Society, Annual National Forum, 34th, Washington, D.C., May 15-17, 1978. Proceedings. (A79-18126 05-01) Washington, D.C., American Helicopter Society, 1978. 8 p. Research supported by the Boeing Vertol Co.:

MAJS: /*AIRCRAFT CONTROL/*CRUISING FLIGHT/*HOVERING/*SPEED CONTROL/*THRUST CONTROL/*TILT ROTOR AIRCRAFT

MINS: / DESIGN ANALYSIS/ DIRECTIONAL CONTROL/ GUST LOADS/ LATERAL CONTROL/ POWER CONDITIONING/ ROTOR SPEED/ SYSTEMS ANALYSIS/ TURBULENCE EFFECTS/ WIND EFFECTS

ABA: (Author)

ABS: The paper reviews the special design criteria which apply to power management in a tilt-rotor aircraft. These include the need for accurate and fast control of rpm and thrust, while accounting for the dynamic interactions between rotor systems caused by cross-shafting and aircraft lateral/directional response. The power management system is also required to provide acceptable high speed sensitivity to longitudinal turbulence. It is shown that the criteria can best be met using a single governor adjusting the collective pitch by an amount proportional to a combination of the average rpm and the integral of the average rpm of the two rotors. This system is evaluated and compared with other candidate systems in hover and cruise flight.

79A18156* ISSUE 5 PAGE 758 CATEGORY 8 RPT#: AHS 78-30 CNT#: NAS1-14549 78/00/00 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotorcraft system identification techniques for handling qualities and stability and control evaluation

AUTH: A/HALL, W. E., JR.; B/GUPTA, N. K.; C/HANSEN, R. S. PAA: C/(Systems Control, Inc., Palo Alto, Calif.)

CORP: Systems Control, Inc. Palo Alto, Calif.

In: American Helicopter Society, Annual National Forum, 34th, Washington, D.C., May 15-17, 1978. Proceedings. (A79-18126 05-01) Washington, D.C., American Helicopter Society, 1978. 23 p.

MAJS: /*AIRCRAFT STABILITY/*COMPUTERIZED DESIGN/*CONTROLLABILITY/*DESIGN ANALYSIS/*HELICOPTER DESIGN/*ROTARY WING AIRCRAFT

MINS: / ALGORITHMS/ DATA PROCESSING/ KALMAN FILTERS/ LEAST SQUARES METHOD/ MAXIMUM LIKELIHOOD ESTIMATES/ ONBOARD EQUIPMENT

ABA: (Author)

ABS: An integrated approach to rotorcraft system identification is described. This approach consists of sequential application of (1) data filtering to estimate states of the system and sensor errors, (2) model structure estimation to isolate significant model effects, and (3) parameter identification to quantify the coefficient of the model. An input design algorithm is described which can be used to design control inputs which maximize parameter estimation accuracy. Details of each aspect of the rotorcraft identification approach are given. Examples of both simulated and actual flight data processing are given to illustrate each phase of processing. The procedure is shown to provide means of calibrating sensor errors in flight data, quantifying high order state variable models from the flight data, and consequently computing related stability and control design models.

79A10903* ISSUE 1 PAGE 13 CATEGORY 5 78/00/00 211 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conference on Helicopter Structures Technology, Moffett Field, Calif., November 16-18, 1977. Proceedings SAP: $10.00

Conference sponsored by the American Helicopter Society and NASA. Moffett Field, Calif., U.S. Army Air Mobility Research and Development Laboratory, 1978.

211 p (For individual items see A79-10904 to A79-10921)

MAJS: /*AIRCRAFT STRUCTURES/*CONFERENCES/*HELICOPTER DESIGN /*STRUCTURAL DESIGN

MINS: / AIRCRAFT MANEUVERS/ BEARINGLESS ROTORS/ COMPOSITE STRUCTURES/ COMPUTERIZED SIMULATION/ DYNAMIC MODELS/ FAIL-SAFE SYSTEMS/ FINITE ELEMENT METHOD/ LANDING GEAR / ROTARY WINGS/ ROTOR BLADES/ STRUCTURAL RELIABILITY/ STRUCTURAL WEIGHT/ ULTRASONIC WELDING

ABA: P.T.H.

ABS: Work on advanced concepts for helicopter designs is reported. Emphasis is on use of advanced composites, damage-tolerant design, and load calculations. Topics covered include structural design flight maneuver loads using PDP-10 flight dynamics model, use of 3-D finite element analysis in design of helicopter mechanical components, damage-tolerant design of the YUH-61A main rotor system, survivability of helicopters to rotor blade ballistic damage, development of a multitubular spar composite main rotor blade, and a bearingless main rotor structural design approach using advanced composites.

79A50202*# ISSUE 22 PAGE 3967 CATEGORY 8 RPT#: AIAA 78-1295 CNT#: NGL-05-020-007 78/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Approach guidance logic for a tilt-rotor aircraft

AUTH: A/BESER, J. PAA: A/(Intermetrics, Inc., Long Beach, Calif.)

CORP: Intermetrics, Inc., Long Beach, Calif.

In: Guidance and Control Conference, Palo Alto, Calif., August 7-9, 1978, Technical Papers. (A78-50159 22-01) New York, American Institute of Aeronautics and Astronautics, Inc., 1978, p. 381-392.

MAJS: /*AIRCRAFT GUIDANCE/*APPROACH CONTROL/*FLIGHT SIMULATION/*TILT ROTOR AIRCRAFT/*WIND EFFECTS

MINS: / AIRCRAFT CONFIGURATIONS/ AIRCRAFT DESIGN/ COMMAND AND CONTROL/ CRUISING FLIGHT/ FEEDBACK CONTROL/ FEEDFORWARD CONTROL/ RESEARCH AIRCRAFT/ TILTING ROTORS

ABA: (Author)

ABS: The distinctive feature of a tilt-rotor aircraft is that the pilot can change the rotor mast angles to go from a helicopter configuration for take-off and landing to an airplane configuration for high cruise speeds and vice-versa. An approach path for such an aircraft is proposed and the logic required to fly along this path in the presence of wind is determined. The main contribution of this work is an efficient and, to my knowledge, new method for generating the nominal state and control histories taking into account an estimate of the mean wind velocity and direction. The method requires the solution of algebraic (mostly linear) equations to generate a 'universal nominal', and feedforward and feedback gains. Then, in flight the additional state and control corrections due to deviation in descent rate, deceleration, and flight in a steady wind are obtained by multiplying simple precalculated functions of time by descent rate, deceleration or sine and cosine components of the mean wind vector. Simulations of approach flights for different wind conditions, assuming perfect state information in the feedback signal, indicated satisfactory performance.

78A35371* ISSUE 14 PAGE 2473 CATEGORY 5 CNT#: DAAG29-C-027 NSG-2095 78/04/22 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: A simplified Mach number scaling law for helicopter rotor noise

AUTH: A/ARAVAMUDAN, K. S.; B/LEE, A.; C/HARRIS, W. L. PAA: C/(MIT, Cambridge, Mass.)

CORP: Massachusetts Inst. of Tech., Cambridge.

Journal of Sound and Vibration, vol. 57, Apr. 22, 1978, p. 555-570.

MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*ROTARY WINGS/*SCALING LAWS

MINS: / ANECHOIC CHAMBERS/ BROADBAND/ MACH NUMBER/ ROTOR BLADES (TURBOMACHINERY)/ TIP SPEED/ WIND TUNNEL TESTS

ABA: P.T.H.

ABS: Mach number scaling laws are derived for the rotational and the high-frequency broadband noise from helicopter rotors. The rotational scaling law is obtained directly from the theory of Lowson and Ollerhead (1969) by exploiting the properties of the dominant terms in the expression for the complex Fourier coefficients of sound radiation from a point source. The scaling law for the high-frequency broadband noise is obtained by assuming that the noise sources are acoustically compact and computing the instantaneous pressure due to an element on an airfoil where vortices are shed. Experimental results on the correlation lengths for stationary airfoils are extended to rotating airfoils. On the assumption that the correlation length varies as the boundary layer displacement thickness, it is found that the Mach number scaling law contains a factor of Mach number raised to the exponent 5.8. Both scaling laws were verified by model tests.

78A14063* ISSUE 3 PAGE 467 CATEGORY 60 CNT#: NAS2-7806 NSF ENG-76-07811 77/11/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Peripheral processors for high-speed simulation --- helicopter cockpit simulator

AUTH: A/KARPLUS, W. J. PAA: A/(California, University, Los

Angeles, Calif.)
CORP: California Univ., Los Angeles.
Simulation, vol. 29, Nov. 1977. p. 143-153.
MAJS: /*COCKPIT SIMULATORS/*COMPUTER SYSTEMS DESIGN/*DIGITAL SIMULATION/*PERIPHERAL EQUIPMENT (COMPUTERS)
MINS: / FLIGHT SIMULATION/ HELICOPTERS/ MINICOMPUTERS
ABA: (Author)
ABS: This paper describes some of the results of a study directed to the specification and procurement of a new cockpit simulator for an advanced class of helicopters. A part of the study was the definition of a challenging benchmark problem, and detailed analyses of it were made to assess the suitability of a variety of simulation techniques. The analyses showed that a particularly cost-effective approach to the attainment of adequate speed for this extremely demanding application is to employ a large minicomputer acting as host and controller for a special-purpose digital peripheral processor. Various realizations of such peripheral processors, all employing state-of-the-art electronic circuitry and a high degree of parallelism and pipelining, are available or under development. The types of peripheral processors array processors, simulation-oriented processors, and arrays of processing elements - are analyzed and compared. They are particularly promising approaches which should be suitable for high-speed simulations of all kinds, the cockpit simulator being a case in point.

77A51092*# ISSUE 24 PAGE 4229 CATEGORY 71
RPT#: AIAA PAPER 77-1339 CNT#: DAAG29-C-027 NSG-2095
77/10/00 11 PAGES UNCLASSIFIED DOCUMENT
UTTL: An experimental investigation of helicopter rotor high frequency broadband noise
AUTH: A/LEE, A.; B/ARAVAMUDAN, K. S.; C/BAUER, P.; D/HARRIS, W. L. PAA: D/(MIT, Cambridge, Mass.)
CORP: Massachusetts Inst. of Tech., Cambridge.
American Institute of Aeronautics and Astronautics, Aeroacoustics Conference, 4th, Atlanta, Ga., Oct. 3-5, 1977. 11 p.
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*NOISE SPECTRA/*ROTARY WINGS
MINS: / ANECHOIC CHAMBERS/ BANDWIDTH/ HIGH FREQUENCIES/ SERRATIA/ SUCTION/ TIP SPEED/ WIND TUNNEL TESTS
ABA: (Author)
ABS: The paper describes experiments involving a 4.17 foot diameter model rotor operating in a 5 times 7.5 ft open jet wind tunnel enclosed in an anechoic chamber. The effects of rotor thrust, advance ratio, and the number of blades on the intensity and spectrum of high frequency broadband noise (HFBN) have been investigated. The effects of each parameter were determined by keeping the other two constant. The directivities of the two- and three-bladed rotors were measured in a direction perpendicular to the plane of the rotor disk. The effects of heading edge, pressure side, and suction side serrations on HFBN were measured under several operating conditions, and the effects of the serrations on the mean thrust generated by the rotor were studied. A scaling law is proposed to determine the location of the peak frequency and intensity of HFBN.

77A43362*# ISSUE 20 PAGE 3361 CATEGORY 5 CNT#: NGR-05-007-414 76/09/00 35 PAGES UNCLASSIFIED DOCUMENT DCAF A002799
UTTL: Recent developments in rotary-wing aeroelasticity
AUTH: A/FRIEDMANN, P. PAA: A/(California, University, Los Angeles, Calif.)
CORP: California Univ., Los Angeles.
Deutsche Gesellschaft fuer Luft- und Raumfahrt, European Rotorcraft and Powered Lift Aircraft Forum, 2nd, Bueckeburg, West Germany, Sept. 20-22, 1976. Paper. 35 p. Army-supported research
MAJS: /*AEROELASTICITY/*RESEARCH AND DEVELOPMENT/*ROTARY WINGS
MINS: / AERODYNAMIC CHARACTERISTICS/ EQUATIONS OF MOTION/ HELICOPTER DESIGN/ HOVERING/ PARTIAL DIFFERENTIAL EQUATIONS/ RIGID ROTORS/ TORSION
ABA: (Author)
ABS: The purpose of this review is to present the research done in rotary-wing aeroelasticity during the past eight years in a unified manner. The following topics are reviewed with considerable detail: (1) recent development in the aeroelastic modeling of the coupled flap-lag-torsional problem in hover (2) effect of unsteady aerodynamics on the coupled flap-lag-torsional aeroelastic problem in hover (3) the coupled flap-lag and the coupled flap-lag-torsional problem in forward flight (4) complete rotor and coupled rotor fuselage aeroelastic problems including both hingeless and teetering rotors.

77A40075* ISSUE 18 PAGE 3006 CATEGORY 8 RPT#: AHS 77-33-44 CNT#: NAS1-13807 NAS1-14358 77/00/00 11 PAGES UNCLASSIFIED DOCUMENT
UTTL: Digital flight control design for a tandem-rotor helicopter
AUTH: A/STENGEL, R. F.; B/BROUSSARD, J. R.; C/BERRY, P. W. PAA: C/(Analytic Sciences Corp., Reading, Mass.)
CORP: Analytic Sciences Corp., Reading, Mass.
In: American Helicopter Society, Annual National Forum, 33rd, Washington, D.C., May 9-11, 1977, Proceedings. (A77-40048 18-01) Washington, D.C.,

American Helicopter Society, Inc., 1977. 11 p.
MAJS: /*CH-47 HELICOPTER/*DIGITAL SYSTEMS/*FLIGHT CONTROL/* HELICOPTER CONTROL/*SYSTEMS ENGINEERING/*TANDEM ROTOR HELICOPTERS
MINS: / CONTROLLABILITY/ EIGENVALUES/ EIGENVECTORS/ FLIGHT CHARACTERISTICS/ OPTIMAL CONTROL/ STATE VECTORS
ABA: (Author)
ABS: Methods and results in the continuing development of a digital flight control system (DFCS) for the CH-47B helicopter are examined. The helicopter is the research vehicle for the NASA VTOL Approach and Landing Technology (VALT) Program. It is equipped with comprehensive equipment for the investigation of navigation, guidance, and control requirements for future VTOL aircraft. Two control modes (attitude-command and velocity-command) are implemented, and each mode provides 'Type 1' response to guidance commands. DFCS design is based upon optimal estimation and control methods, which are found to provide flexible and efficient means for defining practical digital control systems.

77A40062* ISSUE 18 PAGE 3084 CATEGORY 54 RPT#: AHS 77-33-22 77/00/00 9 PAGES UNCLASSIFIED DOCUMENT
UTTL: A kinesthetic-tactual display concept for helicopter-pilot workload reduction
AUTH: A/GILSON, R. D.; B/DUNN, R. S.; C/SUN, P. PAA: A/(Ohio State University, Columbus, Ohio); B/(U.S. Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif.); C/(U.S. Army, Electronics Command, Fort Monmouth, N.J.)
CORP: Ohio State Univ., Columbus.; Army Air Mobility Research and Development Lab., Moffett Field, Calif.; Army Electronics Command, Fort Monmouth, N. J.
In: American Helicopter Society, Annual National Forum, 33rd, Washington, D.C., May 9-11, 1977, Proceedings. (A77-40048 18-01) Washington, D.C., American Helicopter Society, Inc., 1977. 9 p. Research supported by the Ohio State University, U.S. Army, and NASA.
MAJS: /*DISPLAY DEVICES/*HELICOPTER DESIGN/*KINESTHESIA/* PILOT PERFORMANCE/*TACTILE DISCRIMINATION
MINS: / FLIGHT SIMULATORS/ HELICOPTER PERFORMANCE/ MAN MACHINE SYSTEMS/ RESEARCH AND DEVELOPMENT
ABA: (Author)
ABS: A kinesthetic-tactual (K-T) display concept is now under research and development (R & D) at the Ohio State University. It appears to offer considerable promise for useful application in helicopters by conveying control information via the sense of touch. This is a review of the overall R & D program including the original K-T display design, initial studies in automobile and fixed-wing vehicles, and feasibility experiments in a helicopter simulator. In addition to investigations of control and potential workload reduction, present efforts are directed toward establishing optimal design requirements for K-T helicopter displays. Potential applications, modes of usage, and the kinds of information that may be displayed in helicopter applications are discussed along with a brief forecast of future R & D. A brief description of the latest multi-axis laboratory prototype K-T display is also provided.

77A40058* ISSUE 18 PAGE 3001 CATEGORY 5 RPT#: AHS 77-33-14 CNT#: NAS2-7800 77/00/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Performance and safety aspects of the XV-15 tilt rotor research aircraft
AUTH: A/WERNICKE, K. G. PAA: A/(Bell Helicopter Textron, Fort Worth, Tex.)
CORP: Bell Helicopter Co., Fort Worth, Tex.
In: American Helicopter Society, Annual National Forum, 33rd, Washington, D.C., May 9-11, 1977, Proceedings. (A77-40048 18-01) Washington, D.C., American Helicopter Society, Inc., 1977. 10 p.
MAJS: /*AIRCRAFT PERFORMANCE/*AIRCRAFT SAFETY/*XV-15 AIRCRAFT
MINS: / AIRCRAFT CONTROL/ AIRCRAFT STABILITY/ GROUND TESTS/ POWER CONDITIONING/ TILT ROTOR RESEARCH AIRCRAFT PROGRAM
ABA: (Author)
ABS: Aircraft performance is presented illustrating the flexibility and capability of the XV-15 to conduct its planned proof-of-concept flight research in the areas of dynamics, stability and control, and aerodynamics. Additionally, the aircraft will demonstrate mission-type performance typical of future operational aircraft. The aircraft design is described and discussed with emphasis on the safety and fail-operate features of the aircraft and its systems. Two or more levels of redundancy are provided in the dc and ac electrical systems, hydraulics, conversion, flaps, landing gear extension, SCAS, and force-feel. RPM is maintained by a hydro-electrical blade pitch governor that consists of a primary and standby governor with a cockpit wheel control for manual backup. The two engines are interconnected for operation on a single engine. In the event of total loss of power, the aircraft can enter autorotation starting from the airplane as well as the helicopter mode of flight.

77A35925* ISSUE 16 PAGE 2639 CATEGORY 2 CNT#: NAS2-7613 77/04/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Identification of state variables and dynamic inflow from rotor model dynamic tests

AUTH: A/BANERJEE, D.; B/CREWS, S. T.; C/HOHENEMSER, K. H.; D/YIN, S. K. PAA: D/(Washington University, St. Louis, Mo.)

CORP: Washington Univ., St. Louis, Mo.

American Helicopter Society, Journal, vol. 22, Apr. 1977, p. 28-36.

MAJS: /*ROTOR AERODYNAMICS/*STATE VECTORS

MINS: / COMPUTERIZED SIMULATION/ ERROR ANALYSIS/ HARMONIC ANALYSIS/ HELICOPTER DESIGN/ ITERATIVE SOLUTION/ MAXIMUM LIKELIHOOD ESTIMATES/ PARAMETERIZATION

ABA: M.L.

ABS: The paper describes methods for extracting unknown state variables and parameters from dynamic rotor model tests given transient cyclic pitch stirring inputs, blade root flap-bending measurements, and the form of the dynamic rotor equations, including a rotor dynamic inflow description, when none of the physical parameters are known. A simplified version of the maximum likelihood method seems best suited for this purpose. The measurement equation error covariance matrix is assumed constant during each iteration, but updated for the subsequent iteration. A detailed analysis of the suitability of the derived techniques for studying various rotor dynamic inflow effects is provided.

77A28845* ISSUE 12 PAGE 1961 CATEGORY 8 CNT#: NAS1-13807 NAS1-14358 76/00/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Digital controllers for VTOL aircraft

AUTH: A/STENGEL, R. F.; B/BROUSSARD, J. R.; C/BERRY, P. W. PAA: C/(Analytic Sciences Corp., Reading, Mass.)

CORP: Analytic Sciences Corp., Reading, Mass.

In: Conference on Decision and Control and Symposium on Adaptive Processes, 15th, Clearwater, Fla., December 1-3, 1976, Proceedings. (A77-28801 12-63) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 1009-1016.

MAJS: /*ADAPTIVE CONTROL/*DIGITAL SYSTEMS/*HELICOPTER CONTROL/*TANDEM ROTOR HELICOPTERS/*VERTICAL TAKEOFF AIRCRAFT

MINS: / AUTOMATIC FLIGHT CONTROL/ CONTROL THEORY/ MATRICES (MATHEMATICS)/ OPTIMAL CONTROL/ SYSTEMS ENGINEERING/ TERMINAL GUIDANCE

ABA: (Author)

ABS: Using linear-optimal estimation and control techniques, digital-adaptive control laws have been designed for a tandem-rotor helicopter which is equipped for fully automatic flight in terminal area operations. Two distinct discrete-time control laws are designed to interface with velocity-command and attitude-command guidance logic, and each incorporates proportional-integral compensation for non-zero-set-point regulation, as well as reduced-order Kalman filters for sensor blending and noise rejection. Adaptation to flight condition is achieved with a novel gain-scheduling method based on correlation and regression analysis. The linear-optimal design approach is found to be a valuable tool in the development of practical multivariable control laws for vehicles which evidence significant coupling and insufficient natural stability.

77A28634* ISSUE 12 PAGE 1960 CATEGORY 8 CNT#: NGR-47-018-005 76/00/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: A velocity-command controller for a VTOL aircraft

AUTH: A/REID, G. F. PAA: A/(Virginia Military Institute, Lexington, Va.)

CORP: Virginia Military Inst., Lexington.

In: Productivity; Proceedings of the Joint Automatic Control Conference, West Lafayette, Ind., July 27-30, 1976. (A77-28626 12-63) New York, American Society of Mechanical Engineers, 1976, p. 206-210.

MAJS: /*AIRCRAFT CONTROL/*COMMAND AND CONTROL/*FEEDBACK CONTROL/*FEEDFORWARD CONTROL/*SPEED CONTROL/*VERTICAL TAKEOFF AIRCRAFT

MINS: / CH-47 HELICOPTER/ DIGITAL SIMULATION/ HELICOPTER CONTROL/ LINEAR EQUATIONS/ STATE VECTORS/ TRANSFER FUNCTIONS

ABA: (Author)

ABS: A technique is presented for calculating feedback and feedforward gain matrices that enable a VTOL aircraft to track input commands of forward and vertical velocity while maintaining acceptable responses to pilot inputs. Leverrier's algorithm is used for determining a set of state-variable, feedback gains that force the closed-loop poles and zeros of one pilot-input transfer function to pre-selected positions in the s-plane. This set of feedback gains is then used to calculate the feedback and feedforward gains for the velocity-command controller. The method is computationally attractive since the gains are determined by solving systems of linear, simultaneous equations. The method has been used in a digital simulation of the CH-47 helicopter to control longitudinal dynamics.

77A26873* ISSUE 11 PAGE 1772 CATEGORY 8
76/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: RSRA flight control and stabilization --- Rotor Systems Research Aircraft

AUTH: A/LINDEN, A. W. PAA: A/(United Technologies Corp., Sikorsky Aircraft Div., Stratford, Conn.)

CORP: Sikorsky Aircraft, Stratford, Conn.

In: American Helicopter Society, Annual National Forum, 32nd, Washington, D.C., May 10-12, 1976. Proceedings. (A77-26851 11-01) Washington, D.C., American Helicopter Society, 1976, p. 1040-1 to 1040-9. NASA-Army-supported research.

MAJS: /*AIRCRAFT CONFIGURATIONS/*COMPOUND HELICOPTERS/* FLIGHT CONTROL/*FLIGHT STABILITY TESTS/*HELICOPTER PERFORMANCE/*ROTARY WINGS

MINS: / CENTER OF GRAVITY/ FIXED WINGS/ HELICOPTER DESIGN/ WIND TUNNEL TESTS

ABA: R.D.V.

ABS: Handling qualities of the RSRA (rotor systems research aircraft), a special test vehicle with optional configurations (forewings, removable horizontal tailplanes, main rotor, tail rotor, and twin engines for forward flight all removable), are described. The aircraft can be fitted to fly as a conventional rotary-wing aircraft, fixed-wing aircraft, or compound helicopter, and is designed for testing existing and future rotor systems in flight. Controls include full-authority fly-by-wire controls and mechanical controls for rotary wing and for fixed wing. Stability augmentation, rotor test measurement systems, variable center of gravity capability, and rotor loading potential of the RSRA are also described.

77A26868* ISSUE 11 PAGE 1847 CATEGORY 39 CNT#: NAS1-10960 76/00/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aeroelastic characteristics of composite bearingless rotor blades

AUTH: A/BIELAWA, R. L. PAA: A/(United Technologies Research Center, East Hartford, Conn.)

CORP: United Technologies Research Center, East Hartford, Conn.

In: American Helicopter Society, Annual National Forum, 32nd, Washington, D.C., May 10-12, 1976. Proceedings. (A77-26851 11-01) Washington, D.C., American Helicopter Society, 1976, p. 1032-1 to 1032-16.

MAJS: /*AEROELASTICITY/*ELASTIC BENDING/*HELICOPTER DESIGN/* ROTARY WINGS/*ROTOR BLADES/*TORSIONAL STRESS

MINS: / COORDINATE TRANSFORMATIONS/ CORRELATION/ MATRICES (MATHEMATICS)/ REDUNDANCY/ SHEAR STRESS/ TORQUE

ABA: (Author)

ABS: Owing to the inherent unique structural features of composite bearingless rotors, various assumptions upon which conventional rotor aeroelastic analyses are formulated, are violated. Three such features identified are highly nonlinear and time-varying structural twist, structural redundancy in bending and torsion, and for certain configurations a strongly coupled low frequency bending-torsion mode. An examination of these aeroelastic considerations and appropriate formulations required for accurate analyses of such rotor systems is presented. Also presented are test results from a dynamically scaled model rotor and complementary analytic results obtained with the appropriately reformulated aeroelastic analysis.

77A26867* ISSUE 11 PAGE 1761 CATEGORY 5 CNT#: NGR-05-007-414 76/00/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aeroelastic stability of complete rotors with application to a teetering rotor in forward flight

AUTH: A/SHAMIE, J.; B/FRIEDMANN, P. PAA: B/(California, University, Los Angeles, Calif.)

CORP: California Univ., Los Angeles.

In: American Helicopter Society, Annual National Forum, 32nd, Washington, D.C., May 10-12, 1976. Proceedings. (A77-26851 11-01) Washington, D.C., American Helicopter Society, 1976, p. 1031-1 to 1031-19. Army-supported research;

MAJS: /*AERODYNAMIC LOADS/*AEROELASTICITY/*AIRCRAFT STABILITY/*FLIGHT TESTS/*HELICOPTERS/*ROTARY WINGS

MINS: / AERODYNAMIC STABILITY/ EQUATIONS OF MOTION/ NONLINEAR EQUATIONS

ABA: (Author)

ABS: The derivation of a set of nonlinear coupled flap-lag-torsion equations of motion for moderately large deflections of an elastic, two bladed teetering helicopter rotor in forward flight is concisely outlined. The following degrees of freedom are included in the mathematical model: rigid body flapping, rigid body lead lag, elastic bending in flap and lead-lag blade root torsion and shaft torsion. Quasi-steady aerodynamic loads are considered and the effects of reversed flow are included. The aeroelastic stability of the complete rotor is investigated using a linearized system of equations of motion. The equilibrium position about which the equations are linearized is obtained by considering the trim state of the helicopter, in true or simulated forward flight conditions. The sensitivity of the aeroelastic stability boundaries to interblade structural and mechanical coupling is illustrated by comparing the complete rotor stability boundaries with those obtained from a single blade analysis for a number of

hover and forward flight cases.

77A26860* ISSUE 11 PAGE 1760 CATEGORY 5
76/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Higher harmonic rotor blade pitch control

AUTH: A/EWANS, J. R. PAA: A/(Fairchild Republic Co., Farmingdale, N.Y.)

CORP: Fairchild Republic Co., Farmingdale, N. Y.

In: American Helicopter Society, Annual National Forum, 32nd, Washington, D.C., May 10-12, 1976, Proceedings. (A77-26851 11-01) Washington, D.C., American Helicopter Society, 1976, p. 1015-1 to 1015-11. Navy-NASA-sponsored research.

MAJS: /*HELICOPTER CONTROL/*PITCH (INCLINATION)/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / HARMONIC MOTION/ MECHANICAL DRIVES/ REVERSING/ VARIABLE PITCH PROPELLERS

ABA: (Author)

ABS: Tests of a model 'Reverse Velocity Rotor' system at high advance ratios and with twice-per-revolution cyclic pitch control were made under joint Navy-NASA sponsorship in the NASA, Ames 12 ft. pressure tunnel. The results showed significant gains in rotor performance at all advance ratios by using twice-per-revolution control. Detailed design studies have been made of alternative methods of providing higher harmonic motion including four types of mechanical systems and an electro-hydraulic system. The relative advantages and disadvantages are evaluated on the basis of stiffness, weight, volume, reliability and maintainability.

77A25812*# ISSUE 10 PAGE 1562 CATEGORY 5 RPT#: AIAA 77-455 CNT#: NGR-05-007-414 77/00/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aeroelastic stability of coupled flap-lag-torsional motion of helicopter rotor blades in forward flight

AUTH: A/FRIEDMANN, P.; B/REYNA-ALLENDE, M. PAA: B/(California, University, Los Angeles, Calif.)

CORP: California Univ., Los Angeles.

In: Structures, Structural Dynamics and Materials Conference, 18th, March 21-23, 1977, and Dynamics Specialist Conference, San Diego, Calif., March 24, 25, 1977, Technical Papers, Volume B. (A77-25778 10-01) New York, American Institute of Aeronautics and Astronautics, Inc., 1977, p. 314-326. Army-supported research;

MAJS: /*AERODYNAMIC STABILITY/*AEROELASTICITY/*HELICOPTER CONTROL/*MOTION STABILITY/*ROTARY WINGS/*TORSIONAL VIBRATION

MINS: / EQUATIONS OF MOTION/ FLAPS (CONTROL SURFACES)/ FLIGHT CONDITIONS/ FLIGHT SIMULATION/ HOVERING/ NONLINEAR EQUATIONS/ TIME LAG/ WIND TUNNEL TESTS

ABA: F.G.M.

ABS: A set of coupled periodic nonlinear differential flap-lag-torsional equations of blade motion is described which can simulate a blade having a precone, twist, distributed torsion, root torsion, torque offset, blade-root offsets, and offsets among the elastic axis, the aerodynamic center, and the blade cross-sectional center of mass. It is noted that the aerodynamic loads derived for these equations are applicable to cases of both hover and forward flight. The aeroelastic stability of a hingeless helicopter blade is investigated by linearizing the nonlinear differential equations of motion about a time-dependent equilibrium position of the helicopter in forward flight, using propulsion and moment trim procedures. A comparison of the results with those obtained previously for coupled flap-lag-torsional boundaries in hover indicates that aeroelastic-stability margins are degraded due to forward flight.

76A47210* ISSUE 24 PAGE 3853 CATEGORY 63 CNT#: NGR-47-018-005 76/00/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: A technique for pole-zero placement for dual-input control systems --- computer simulation of CH-47 helicopter longitudinal dynamics

AUTH: A/REID, G. F. PAA: A/(Virginia Military Institute, Lexington, Va.)

CORP: Virginia Military Inst., Lexington.

In: Engineering in a changing economy: Proceedings of the Southeast Region 3 Conference, Clemson, S.C., April 5-7, 1976. (A76-47201 24-99) New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 112-114.

MAJS: /*CH-47 HELICOPTER/*COMPUTERIZED SIMULATION/*CONTROL SIMULATION/*HELICOPTER CONTROL/*LONGITUDINAL CONTROL

MINS: / ALGORITHMS/ FEEDBACK CONTROL/ LINEAR EQUATIONS/ TRANSFER FUNCTIONS

ABA: (Author)

ABS: A technique is presented for determining state variable feedback gains that will place both the poles and zeros of a selected transfer function of a dual-input control system at pre-determined locations in the s-plane. Leverrier's algorithm is used to determine the numerator and denominator coefficients of the closed-loop transfer function as functions of the feedback gains. The values of gain that match these coefficients to those of a pre-selected model are found by solving two systems of linear simultaneous equations. The algorithm has been used in a computer simulation of the CH-47 helicopter to

control longitudinal dynamics.

76A38080*# ISSUE 18 PAGE 2874 CATEGORY 71
RPT#: AIAA PAPER 76-564 CNT#: NAS2-7684 76/07/00
8 PAGES UNCLASSIFIED DOCUMENT
UTTL: An experimental study of helicopter rotor rotational noise in a wind tunnel
AUTH: A/LEE, A.; B/HARRIS, W. L.; C/WIDNALL, S. E. PAA: C/(MIT, Cambridge, Mass.)
CORP: Massachusetts Inst. of Tech., Cambridge.
American Institute of Aeronautics and Astronautics, Aero-Acoustics Conference, 3rd, Palo Alto, Calif., July 20-23, 1976, 8 p.
MAJS: /*AIRCRAFT NOISE/*HELICOPTERS/*ROTARY WINGS/*WIND TUNNEL TESTS
MINS: / ACOUSTIC MEASUREMENT/ ANECHOIC CHAMBERS/ DATA PROCESSING/ DIRECTIVITY
ABA: (Author)
ABS: The rotational noise of model helicopter rotors in forward flight was studied in an anechoic wind tunnel. The parameters under study were the rotor thrust (blade loading), blade number and advance ratio. The separate effects of each parameter were identified with the other parameters being held constant. The directivity of the noise was also measured. Twelve sets of data for rotational noise as a function of frequency were compared with the theory of Lowson and Ollerhead. In general, the agreement is reasonably good, except for the cases of (1) low and high disk loadings, (2) the four bladed rotor, and (3) low advance ratios. The theory always under-estimates the rotational noise at high harmonics.

76A35850* ISSUE 17 PAGE 2590 CATEGORY 6
76/07/00 7 PAGES UNCLASSIFIED DOCUMENT
UTTL: A model-based analysis of a display for helicopter landing approach
AUTH: A/HESS, R. A.; B/WHEAT, L. W PAA: B/(U.S. Naval Postgraduate School, Monterey, Calif.)
CORP: Naval Postgraduate School, Monterey, Calif.
IEEE Transactions on Systems, Man, and Cybernetics, vol. SMC-6, July 1976, p. 505-511. NASA-supported research.
MAJS: /*AIRCRAFT LANDING/*APPROACH CONTROL/*CONTROL SIMULATION/*DISPLAY DEVICES/*HELICOPTER CONTROL/*MAN MACHINE SYSTEMS/*PILOT PERFORMANCE
MINS: / COCKPITS/ COMPUTERIZED SIMULATION/ HELICOPTER PERFORMANCE/ MANUAL CONTROL/ MATHEMATICAL MODELS
ABA: (Author)
ABS: A control theoretic model of the human pilot was used to analyze a baseline electronic cockpit display in a helicopter landing approach task and to generate display quickening laws designed to improve pilot-vehicle performance. A simple fixed base simulation provided comparative tracking data which allowed refinement of the pilot model.

76A32849*# ISSUE 15 PAGE 2239 CATEGORY 5 CNT#: NGR-05-007-414 75/09/00 30 PAGES UNCLASSIFIED DOCUMENT
UTTL: Aeroelastic stability of trimmed helicopter blades in forward flight
AUTH: A/FRIEDMANN, P.; B/SHAMIE, J. PAA: B/(California, University, Los Angeles, Calif.)
CORP: California Univ., Los Angeles.
European Rotorcraft and Powered Lift Aircraft Forum, 1st, University of Southampton, Southampton, England, Sept. 22-24, 1975, Paper, 30 p. Army-supported research;
MAJS: /*AERODYNAMIC STABILITY/*AEROELASTICITY/*HELICOPTERS/*RIGID ROTORS/*ROTARY WINGS
MINS: / AERODYNAMIC LOADS/ EQUATIONS OF MOTION/ FLIGHT CHARACTERISTICS/ FLOQUET THEOREM/ LINEAR EQUATIONS
ABA: (Author)
ABS: Equations for moderately large amplitude coupled flap-lag motion of a torsionally rigid hingeless elastic helicopter blade in forward flight are derived. Quasi-steady aerodynamic loads are considered and the effects of reversed flow are included. By using Galerkin's method the spatial dependence of the problem is eliminated and the equations are linearized about a time dependent equilibrium position determined from the trimmed equilibrium position of the rotor in forward flight. In the first trim procedure the rotor is maintained at a fixed value of thrust coefficient with forward flight and horizontal and vertical force equilibrium is satisfied in addition to maintaining zero pitch and roll moments. The second trim procedure maintains only zero pitch and roll moment simulating conditions under which a rotor would be tested in the wind tunnel.

76A30861*# ISSUE 14 PAGE 2097 CATEGORY 8 CNT#: NAS2-5143 76/03/00 6 PAGES UNCLASSIFIED DOCUMENT
UTTL: Near-hover control of a helicopter with a hanging load
AUTH: A/GUPTA, N. K.; B/BRYSON, A. E., JR. PAA: A/(Systems Control, Inc., Palo Alto, Calif.); B/(Stanford University, Stanford, Calif.)
CORP: Stanford Univ., Calif.; Systems Control, Inc., Palo Alto, Calif.
Journal of Aircraft, vol. 13, Mar. 1976, p. 217-222.
MAJS: /*AUTOMATIC PILOTS/*GUST LOADS/*HELICOPTER CONTROL/*HOVERING/*PERFORMANCE PREDICTION
MINS: / CABLES (ROPES)/ FEEDBACK CONTROL/ HELICOPTER DESIGN/

POSITION ERRORS/ WIND EFFECTS

ABA: (Author)

ABS: Piloting a helicopter with a hanging load is a difficult task, especially when the mass of the load is a significant fraction of the mass of the vehicle and there are gusty winds. An autopilot logic is proposed here for controlling the helicopter in this configuration and for precision hover. It is proposed that the vehicle position be measured using a lightweight cable from the helicopter to a point on the ground near the desired hover point. Simulation with one version of S-61 Sikorsky helicopter shows satisfactory controller performance under both design conditions and for parameter changes from one mission to another. Assuming noise-free measurements for feedback is found to be far too optimistic in predicting performance, the sensor/estimator design is a key element in the controller.

76A30047*# ISSUE 13 PAGE 1970 CATEGORY 39
CNT#: NGR-05-007-414 76/00/00 14 PAGES
UNCLASSIFIED DOCUMENT

UTTL: Effect of modified aerodynamic strip theories on rotor blade aeroelastic stability

AUTH: A/FRIEDMANN, P.; B/YUAN, C. PAA: B/(California, University, Los Angeles, Calif.)

CORP: California Univ., Los Angeles.
In: Structures, Structural Dynamics, and Materials Conference, 17th, King of Prussia, Pa., May 5-7, 1976, Proceedings. (A76-30004 13-39) New York, American Institute of Aeronautics and Astronautics, Inc., 1976, p. 398-411.

MAJS: /*AEROELASTICITY/*AIRCRAFT STABILITY/*FIXED WINGS/*ROTARY WINGS/*ROTOR BLADES

MINS: / ANGLE OF ATTACK/ DYNAMIC STRUCTURAL ANALYSIS/ FREE FLOW/ HELICOPTER DESIGN/ HOVERING/ ROTOR AERODYNAMICS/ STRIP/ WING FLAPS

ABA: (Author)

ABS: Various existing unsteady aerodynamic strip theories which have been developed in the past for both fixed and rotary wing aeroelastic analyses are modified in the paper so as to make them applicable to the coupled flap-lag-torsional aeroelastic problem of a rotor blade in hover. These corrections are primarily due to constant angle of attack, constant inflow and variable free stream velocity due to lead-lag motion. Next, the modified strip theories are incorporated in a coupled flap-lag-torsional aeroelastic analysis of the rotor blade in hover and the sensitivity of the aeroelastic stability boundaries to the aerodynamic assumptions is examined.

76A20929*# ISSUE 8 PAGE 1071 CATEGORY 2 RPT#: AIAA PAPER 76-81 CNT#: NAS1-13372 76/01/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Vortex noise from nonrotating cylinders and airfoils

AUTH: A/SCHLINKER, R. H.; B/AMIET, R. K.; C/FINK, M. R. PAA: B/(United Technologies Research Center, East Hartford, Conn.)

CORP: United Technologies Research Center, East Hartford, Conn.
American Institute of Aeronautics and Astronautics, Aerospace Science Meeting, 14th, Washington, D.C., Jan. 26-28, 1976, 17 p.

MAJS: /*AERODYNAMIC NOISE/*AIRCRAFT NOISE/*HELICOPTER TAIL ROTORS/*SOUND GENERATORS/*VORTEX STREETS/*WIND TUNNEL TESTS

MINS: / ACOUSTIC MEASUREMENT/ AIRFOILS/ CIRCULAR CYLINDERS/ FULL SCALE TESTS/ NOISE SPECTRA/ REYNOLDS NUMBER/ SOUND FIELDS/ SURFACE ROUGHNESS EFFECTS

ABA: (Author)

ABS: An experimental study of vortex-shedding noise was conducted in an acoustic research tunnel over a Reynolds-number range applicable to full-scale helicopter tail-rotor blades. Two-dimensional tapered-chord nonrotating models were tested to simulate the effect of spanwise frequency variation on the vortex-shedding mechanism. Both a tapered circular cylinder and tapered airfoils were investigated. The results were compared with data for constant-diameter cylinder and constant-chord airfoil models also tested during this study. Far-field noise, surface pressure fluctuations, and spanwise correlation lengths were measured for each configuration. Vortex-shedding noise for tapered cylinders and airfoils was found to contain many narrowband-random peaks which occurred within a range of frequencies corresponding to a predictable Strouhal number referenced to the maximum and minimum chord. The noise was observed to depend on surface roughness and Reynolds number.

76A14577* ISSUE 4 PAGE 441 CATEGORY 4 CNT#: NAS1-12199 75/00/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Analysis of navigation and guidance requirements for commercial VTOL operations

AUTH: A/HOFFMAN, W. C.; B/ZVARA, J.; C/HOLLISTER, W. M. PAA: B/(Aerospace Systems, Inc., Burlington, Mass.); C/(MIT, Cambridge, Mass.)

CORP: Aerospace Systems, Inc., Burlington, Mass.; Massachusetts Inst. of Tech., Cambridge.
In: American Helicopter Society, Annual National Forum, 31st, Washington, D.C., May 13-15, 1975, Proceedings. (A76-14565 04-05) New York, American

Helicopter Society, Inc., 1975. 17 p.
MAJS: /*AIR NAVIGATION/*AIRCRAFT GUIDANCE/*COMMERCIAL AIRCRAFT/*HELICOPTER CONTROL/*VERTICAL TAKEOFF AIRCRAFT
MINS: / AIR TRANSPORTATION/ AIRCRAFT LANDING/ CRUISING FLIGHT/ TAKEOFF/ TERMINAL GUIDANCE
ABA: P.T.H.
ABS: The paper presents some results of a program undertaken to define navigation and guidance requirements for commercial VTOL operations in the takeoff, cruise, terminal and landing phases of flight in weather conditions up to and including Category III. Quantitative navigation requirements are given for the parameters range, coverage, operation near obstacles, horizontal accuracy, multiple landing aircraft, multiple pad requirements, inertial/radio-inertial requirements, reliability/redundancy, update rate, and data link requirements in all flight phases. A multi-configuration straw-man navigation and guidance system for commercial VTOL operations is presented. Operation of the system is keyed to a fully automatic approach for navigation, guidance and control, with pilot as monitor-manager. The system is a hybrid navigator using a relatively low-cost inertial sensor with DME updates and MLS in the approach/departure phases.

75A47419*# ISSUE 24 PAGE 3485 CATEGORY 2
75/10/00 8 PAGES UNCLASSIFIED DOCUMENT
UTTL: Bringing wings of change - NASA's airfoil research program
AUTH: A/PIERPONT, P. K. PAA: A/(NASA, Langley Research Center, Subsonic-Transonic Aerodynamics Div., Hampton, Va.)
Astronautics and Aeronautics, vol. 13, Oct. 1975, p. 26-27.
MAJS: /*AIRFOILS/*COMPUTERIZED DESIGN/*NASA PROGRAMS
MINS: / AERODYNAMIC DRAG/ LIFT/ OPTIMIZATION/ PRESSURE DISTRIBUTION/ TEST FACILITIES/ THIN WINGS/ TRANSONIC FLOW/ WIND TUNNEL STABILITY TESTS
ABA: C.K.D.
ABS: A review is presented of progress in attaining technical objectives in three areas of semiautomatic airfoil development: software, hardware, and applications. Software objectives seek improved mathematical models and computer codes for flow analysis and design optimization for a variety of conditions. The 17-step iterative computer model used in designing the GA (W)-1 airfoil is effective but not yet fully automated; with present methods only single-point computer optimization is possible. Hardware objectives calling for improvement in test facilities and techniques are met in part by the introduction of the Langley (F-3C) wind tunnel for independent evaluation of transonic Mach number and Reynolds effects up to 12-16 million, and by a two-dimensional test section for the Langley 1/3 transonic cryogenic tunnel which will extend the Reynolds number to 50 million. The current status of low-speed, thin, and rotorcraft airfoil development programs is discussed.

75A38356*# ISSUE 18 PAGE 2630 CATEGORY 5
75/00/00 26 PAGES UNCLASSIFIED DOCUMENT
UTTL: A comprehensive plan for helicopter drag reduction
AUTH: A/WILLIAMS, R. M.; B/MONTANA, P. S. PAA: B/(U.S. Naval National Command, Ship Research and Development Center, Bethesda, Md.)
In: National Symposium on Helicopter Aerodynamic Efficiency, Hartford, Conn., March 6, 7, 1975, Proceedings. (A75-38340 18-05) New York, American Helicopter Society, Inc., 1975, p. 13.1-13.26. Navy-NASA-Army-supported research.
MAJS: /*AERODYNAMIC DRAG/*BLUFF BODIES/*DRAG REDUCTION/*HELICOPTER DESIGN/*SEPARATED FLOW
MINS: / BOUNDARY LAYER CONTROL/ COMPUTER GRAPHICS/ DOWNWASH/ FLOW CHARACTERISTICS/ FUSELAGES/ HELICOPTER WAKES/ POTENTIAL FLOW
ABA: (Author)
ABS: Current helicopters have parasite drag levels 6 to 10 times as great as fixed wing aircraft. The commensurate poor cruise efficiency results in a substantial degradation of potential mission capability. The paper traces the origins of helicopter drag and shows that the problem (primarily due to bluff body flow separation) can be solved by the adoption of a comprehensive research and development plan. This plan, known as the Fuselage Design Methodology, comprises both nonaerodynamic and aerodynamic aspects. The aerodynamics are discussed in detail and experimental and analytical programs are described which will lead to a solution of the bluff body problem. Some recent results of work conducted at the Naval Ship Research and Development Center (NSRDC) are presented to illustrate these programs. It is concluded that a 75-per cent reduction of helicopter drag is possible by the full implementation of the Fuselage Design Methodology.

75A38349*# ISSUE 18 PAGE 2623 CATEGORY 2
75/00/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: An analytical and experimental evaluation of airfoil sections for helicopter rotor application

AUTH: A/BINGHAM, G. J.; B/NOONAN, K. W. PAA: B/(U.S. Army. Air Mobility Research and Development Laboratory; NASA. Langley Research Center. Airfoil Research Section. Hampton, Va.)

In: National Symposium on Helicopter Aerodynamic Efficiency. Hartford, Conn., March 6. 7. 1975. Proceedings. (A75-38340 18-05) New York. American Helicopter Society. Inc.. 1975. p. 9.1-9.10.

MAJS: /*AERODYNAMIC COEFFICIENTS/*AIRFOIL PROFILES/* HELICOPTER DESIGN/*ROTARY WINGS

MINS: / LIFT DRAG RATIO/ MACH NUMBER/ PREDICTION ANALYSIS TECHNIQUES/ WING LOADING

ABA: S.D.

ABS: The influence of the more independent airfoil parameters such as thickness. thickness distribution. leading-edge radius. camber. and camber distribution on lift-Mach number characteristics is investigated at lift coefficients up to near-maximum lift. The analysis is based on the drag divergence Mach number (Md) prediction techniques. where Md is the free-stream Mach number at which the rate of increase of drag coefficient with Mach number equals 0.1. The analytical results obtained indicate the compromises in Md which result from changes in thickness ratio. location of maximum thickness. leading edge radius. camber addition. and location of maximum camber for four- and five-digit airfoils and some six-series airfoils of potential interest for helicopters. An example of airfoil sections which combines several of the favorable geometric changes is evaluated analytically and experimentally. A comparison of results shows that the relative effect of the geometric changes on the lift coefficient-Md relation is realistic. and that the methods of analysis employed can be effectively used during preliminary vehicle design and airfoil selection.

75A38345*# ISSUE 18 PAGE 2623 CATEGORY 2
75/00/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: Summary of results indicating the beneficial effects of rotor vortex modification

AUTH: A/WHITE, R. P., JR.; B/BALCERAK, J. C.; C/PEGG, R. J. PAA: B/(Systems Research Laboratories. Inc., Rochester, N.Y.); C/(NASA. Langley Research Center. Hampton, Va.)

In: National Symposium on Helicopter Aerodynamic Efficiency. Hartford. Conn., March 6. 7. 1975. Proceedings. (A75-38340 18-05) New York. American Helicopter Society. Inc.. 1975. p. 5.1-5.15.

MAJS: /*AIRCRAFT NOISE/*HELICOPTER PERFORMANCE/*ROTARY WINGS /*ROTOR AERODYNAMICS/*VORTEX INJECTORS

MINS: / AIR FLOW/ BLADE TIPS/ GAS INJECTION/ NOISE REDUCTION

ABA: S.D.

ABS: The possibility of reducing blade-slap noise and high-frequency air loads and of increasing performance by tip air mass injection (TAMI) is investigated. The discussion is limited to two types of TAMI: chordwise injection with air injected at the blade tip in a chordwise direction and spanwise injection with air injected in a spanwise direction. Experimental and analytical results indicate that a properly designed TAMI system can restructure the near field characteristics of a concentrated vortex that trails off the tip of a lifting surface. that the tip vortex is spread by the application of chordwise TAMI. that mixing exists between the injected air mass and the vortex flow which enhances vortex decay. that the net power requirements to implement the system on operational helicopters are within acceptable levels. that maximum drop of noise level reductions of about 25 dB can be achieved, and that a decrease in the drag induced by the tip vortex in a spanwise TAMI system can be obtained by restructuring the vortex as it forms along the airfoil chord and by moving the vortex farther outboard of the tip.

75A37595*# ISSUE 18 PAGE 2628 CATEGORY 5
75/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotorcraft low-speed download drag definition and its reduction

AUTH: A/WILSON, J. C. PAA: A/(U.S. Army. Air Mobility Research and Development Laboratory; NASA. Langley Research Center. Low-Speed Aerodynamics Branch. Hampton, Va.)

In: Rotorcraft parasite drag; Proceedings of the Thirty-first Annual National Forum. Washington. D.C., May 14. 15. 1975. (A75-37593 18-01) New York. American Helicopter Society. Inc.. 1975. p. 4.1-4.9.

MAJS: /*DRAG REDUCTION/*HELICOPTER DESIGN/*HOVERING/*LOW SPEED STABILITY/*ROTOR SPEED/*ROTORCRAFT AIRCRAFT

MINS: / AIRCRAFT FUELS/ HELICOPTER PERFORMANCE/ PAYLOADS/ POTENTIAL FLOW/ ROTOR AERODYNAMICS

ABA: (Author)

ABS: Download drag for rotorcraft in hover and low-speed flight is a burden which significantly affects useful load. fuel. and payload. Reduction of the burden will enhance these aspects of rotorcraft and complement the forthcoming improvements in isolated rotor performance. Analyses and experimental data are available. though fragmentary. regarding gross drag. thrust recovery. and other characteristics which can be utilized to define interim rotorcraft design

changes to reduce the burden. Eventually the experimental data and a comprehensive combination of rotor, rotor-wake, and potential-flow analyses can evolve to reduce the burden to an absolute minimum.

75A33485*# ISSUE 15 PAGE 2119 CATEGORY 2
75/04/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Theoretical study of lift-generated vortex wakes designed to avoid rollup

AUTH: A/ROSSOW, V. J. PAA: A/(NASA. Ames Research Center, Moffett Field, Calif.)
AIAA Journal, vol. 13, Apr. 1975, p. 476-484.

MAJS: /*AERODYNAMIC FORCES/*AIRCRAFT WAKES/*LIFTING BODIES/*ROLLING MOMENTS/*VORTEX SHEETS

MINS: / FLOW CHARACTERISTICS/ HELICOPTER WAKES/ LIFTING ROTORS/ NUMERICAL ANALYSIS/ RADIAL DISTRIBUTION/ TURBULENT FLOW/ VELOCITY DISTRIBUTION/ VORTEX GENERATORS

ABA: (Author)

ABS: Two hypothetical vortex wakes are introduced and studied theoretically to explore whether the rollup of lift-generated vortex sheets can be suppressed. The circulation distribution across each wake is specified such that one rotates and the other translates as a unit due to their self-induced velocities. Several span loadings are constructed from these solutions and the resulting inviscid wake structure is computed for several span lengths behind the generating wing by use of the discrete vortex method wherein the vortex wake is represented by an array of vortices. The final distribution of vortices is then used to estimate the rolling moment on an encountering wing. It is found that, even though the initial specified motions are not sustained, substantial reductions in rolling moment are predicted for certain ranges of the ratio of the span of the generating wing to the following wing.

75A25735*# ISSUE 10 PAGE 1397 CATEGORY 2 RPT#: AIAA PAPER 75-453 CNT#: NGR-09-010-085 75/03/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Thickness noise of helicopter rotors at high tip speeds

AUTH: A/FARASSAT, F.; B/PEGG, R. J.; C/HILTON, D. A. PAA: A/(NASA. Langley Research Center; George Washington University, Hampton, Va.); C/(NASA. Langley Research Center, Hampton, Va.)
American Institute of Aeronautics and Astronautics, Aero-Acoustics Conference, 2nd, Hampton, Va., Mar. 24-26, 1975, 7 p.

MAJS: /*AERODYNAMIC NOISE/*NOISE MEASUREMENT/*ROTARY WINGS/*ROTOR SPEED/*TIP SPEED

MINS: / AIRFOIL PROFILES/ COMPUTER PROGRAMS/ FAR FIELDS/ HELICOPTER PERFORMANCE/ HIGH SPEED/ NOISE REDUCTION

ABA: (Author)

ABS: A new formulation of helicopter rotor thickness noise for hover and forward flight, is discussed. The parameters required for this formulation are rotor motion, planform and airfoil thickness distribution. A computer program has been developed to calculate the pressure signature due to blade thickness for a helicopter in arbitrary motion. Comparison with high-speed helicopter tests shows good agreement with calculations when the observer is in or near the horizontal plane in which the rotor disk lies. Characteristics of thickness noise are illustrated by numerical examples indicating strongly that the high-speed blade slap may be due primarily to the thickness effect. The methods of Deming and Arnoldi are discussed as the special cases of this technique.

75A22497*# ISSUE 8 PAGE 1067 CATEGORY 5 RPT#: AIAA PAPER 75-275 CNT#: NAS2-8048 75/02/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotary-wing aircraft systems for the short-haul market

AUTH: A/MAGEE, J. P.; B/CLARK, R. D.; C/GIULIANETTI, D. PAA: B/(Boeing Vertol Co., Philadelphia, Pa.); C/(NASA, Washington, D.C.)
American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 11th, Washington, D.C., Feb. 24-26, 1975, 10 p.

MAJS: /*HELICOPTER DESIGN/*PASSENGER AIRCRAFT/*ROTARY WING AIRCRAFT/*SHORT HAUL AIRCRAFT

MINS: / COST ANALYSIS/ DESIGN ANALYSIS/ FUEL CONSUMPTION/ NOISE REDUCTION/ TANDEM ROTOR HELICOPTERS/ TECHNOLOGICAL FORECASTING/ TILTING ROTORS/ V/STOL AIRCRAFT

ABA: (Author)

ABS: This paper describes preliminary designs of tilt-rotor and tandem-rotor helicopter V/STOL aircraft for the 1958 short-haul market. These designs include a tilt-rotor aircraft designed for STOL-only operation. The baseline designs are presented with technological and cost data. The impact of noise and ride qualities on aircraft size and cost, and on passenger acceptance are discussed. The results of the study are compared against competitive alternatives in air transportation.

75A20285*# ISSUE 7 PAGE 910 CATEGORY 2 RPT#: AIAA PAPER 75-168 75/01/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Numerical calculation of unsteady transonic potential flow over helicopter rotor blades

AUTH: A/CARADONNA, F. X.; B/ISOM, M. P. PAA: A/(NASA, Ames Research Center; U.S. Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif.); B/(New York, Polytechnic Institute, Brooklyn, N.Y.)
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 13th, Pasadena, Calif., Jan. 20-22, 1975, 8 p.

MAJS: /*HELICOPTER PERFORMANCE/*POTENTIAL FLOW/*ROTARY WINGS /*ROTOR BLADES/*TRANSONIC FLOW/*UNSTEADY FLOW

MINS: / ASPECT RATIO/ MACH NUMBER/ ROTOR AERODYNAMICS/ SUPERCRITICAL FLOW/ UPSTREAM

ABA: (Author)

ABS: The small-disturbance potential equation appropriate to a helicopter in forward flight is derived. This equation is then solved for the flow over a nonlifting transonic rotor blade, using a completely implicit scheme that is an extension of the Murman-Cole mixed-difference technique. The flow in the tip region is most unsteady in the decelerating flow region, after the blade passes the psi = 90 deg azimuthal station. The unsteadiness appears to be caused by expansion and compression waves that move slowly upstream of the blade as the relative incident flow decelerates. The influence of aspect ratio, advance ratio, and Mach number on this process is discussed.

75A19572* ISSUE 6 PAGE 842 CATEGORY 45 CNT#: NAS1-12495 75/01/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: A study of noise guidelines for community acceptance of civil-helicopter operations

AUTH: A/MUNCH, C. L. PAA: A/(United Aircraft Corp., Sikorsky Aircraft Div., Stratford, Conn.)
American Helicopter Society, Journal, vol. 20, Jan. 1975, p. 11-19.

MAJS: /*AIRCRAFT NOISE/*HELICOPTER PERFORMANCE/*NOISE INTENSITY/*NOISE POLLUTION/*POLLUTION CONTROL

MINS: / ACOUSTIC MEASUREMENT/ CIVIL AVIATION/ PASSENGER AIRCRAFT/ REGULATIONS/ SOCIAL FACTORS/ TRANSPORT AIRCRAFT

ABA: A.T.S.

ABS: The Day-Night Noise Level, which takes tonal content, duration, and number of operations into account, and penalizes night-time noise, is found to be the best available index for rating community annoyance caused by aircraft. A Day-Night level of 60 for communities with ambient noise levels up to 58 dBA, and a level of 2 dBA higher than the ambient for communities where it is above 58 dBA, is proposed as acceptable. Evaluation of a large transport helicopter showed that the guidelines do not impose severe economic penalties on helicopter operations.

75A18384*# ISSUE 6 PAGE 764 CATEGORY 5 RPT#: AIAA PAPER 75-205 CNT#: NAS2-6784 75/01/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Effect of at-the-source noise reduction on performance and weights of a tilt-rotor aircraft

AUTH: A/GIBS, J.; B/STEPNIEWSKI, W. Z.; C/SPENCER, R. PAA: C/(Boeing Vertol Co., Philadelphia, Pa.)
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 13th, Pasadena, Calif., Jan. 20-22, 1975, 13 p.

MAJS: /*AIRCRAFT NOISE/*DESIGN ANALYSIS/*NOISE REDUCTION/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*VERTICAL TAKEOFF AIRCRAFT

MINS: / ACOUSTIC MEASUREMENT/ AIRCRAFT PERFORMANCE/ FAR FIELDS/ STRUCTURAL WEIGHT

ABA: (Author)

ABS: Reduction of far-field acoustic signature through modification of basic design parameters (tip speed, number of blades, disc loading and rotor blade area) was examined, using a tilt-rotor flight research aircraft as a baseline configuration. Of those design parameters, tip speed appeared as the most important. Next, preliminary design of two aircraft was performed, postulating the following reduction of noise level from that of the baseline machine, at 500 feet from the spot of OGE hover. In one aircraft, the PNL was lowered by 10 PNdB and in the other, OASPL decreased by 10 dB. The resulting weight and performance penalties were examined. Then, PNL and EPNL aspects of terminal operation were compared for the baseline and quieter aircraft.

75A15952*# ISSUE 4 PAGE 476 CATEGORY 2 74/12/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Lifting-surface theory for a semi-infinite wing in oblique gust

AUTH: A/CHU, S.; B/WIDNALL, S. E. PAA: A/(MIT, Cambridge, Mass.; NASA, Ames Research Center, Moffett Field, Calif.); B/(MIT, Cambridge, Mass.)
AIAA Journal, vol. 12, Dec. 1974, p. 1672-1678.
Navy-supported research.

MAJS: /*GUST LOADS/*LIFTING BODIES/*SURFACE GEOMETRY/*THIN WINGS/*WIND EFFECTS/*WING PROFILES

MINS: / COMPRESSIBLE FLOW/ HELICOPTER DESIGN/ NUMERICAL ANALYSIS/ ROTARY WINGS/ ROTOR BLADES/ TURBULENCE EFFECTS/ TWO DIMENSIONAL BODIES

ABA: (Author)

ABS: An unsteady lifting-surface theory is developed for

the calculation of the airload on a semi-infinite-span thin wing in a compressible flow due to interaction with an oblique gust. By using the solutions obtained for a two-dimensional wing, the problem is formulated so that the unknown is taken to be the difference between the airload on the semi-infinite wing and that on a two-dimensional wing under the same gust conditions. Since this airload difference is nonzero only near the wing tip, the control points need be distributed in the tip region only; this significantly simplifies the numerical procedure. Results are presented for a wing with rectangular tip. The implication for noise and unsteady loads due to blade-vortex interaction for helicopter rotors is discussed.

75A12197*# ISSUE 2 PAGE 220 CATEGORY 37 RPT#: ASLE PREPRINT 74LC-1C-2 CNT#: NAS3-16720 74/10/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Mainshaft seals for small gas turbine engines

AUTH: A/LUDWIG, L. P.; B/LYNWANDER, P. PAA: A/(NASA, Lewis Research Center, Cleveland, Ohio); B/(Avco Corp., Lycoming Div., Stratford, Conn.) SAP: MEMBERS, $1.50; NONMEMBERS, $3.00

American Society of Lubrication Engineers and American Society of Mechanical Engineers, Joint Lubrication Conference, Montreal, Canada, Oct. 8-10, 1974. ASLE 12 p. Army-supported research:

MAJS: /*GAS TURBINE ENGINES/*HELICOPTER ENGINES/*ROTATING SHAFTS/*SEALS (STOPPERS)

MINS: / AIR FLOW/ GAS-SOLID INTERFACES/ HIGH TEMPERATURE AIR / LIFT AUGMENTATION

ABA: (Author)

ABS: An experimental evaluation of mainshaft seals for small gas turbine engines was conducted with shaft speeds to 213 m/sec, air pressures to 215 psia, and air temperatures to 412 K. A radial face seal incorporating self-acting geometry for lift augmentation was evaluated. In addition, three conventional carbon seal types (face, circumferential segmented, and rotating ring) were run for comparison. Test results indicated that the conventional seals used in this evaluation may not be satisfactory in future advanced engines because of excessive air leakage. On the other hand, the self-acting face seal was shown to have the potential capability of limiting leakages to one-half that of the conventional face seals and one-fifth that of conventional ring seals. A 150 hour endurance test of the self-action face seal was conducted at speeds to 145 m/sec, air pressures to 180 psia, and air temperatures to 408 K. The seal wear was not measurable.

75A11823* ISSUE 2 PAGE 248 CATEGORY 47 74/10/00 20 PAGES UNCLASSIFIED DOCUMENT

UTTL: A boundary-layer analysis of atmospheric motion over a semi-elliptical surface obstruction

AUTH: A/FROST, W.; B/MAUS, J. R.; C/(NASA, Marshall Space Flight Center, Huntsville, Ala.) Boundary-Layer Meteorology, vol. 7, Oct. 1974, p. 165-184.

MAJS: /*ATMOSPHERIC BOUNDARY LAYER/*BOUNDARY LAYER EQUATIONS /*ELLIPTICAL CYLINDERS/*FLOW DISTORTION/*SURFACE ROUGHNESS EFFECTS/*TURBULENT BOUNDARY LAYER

MINS: / ASPECT RATIO/ ATMOSPHERIC TURBULENCE/ FLOW VELOCITY/ PRESSURE GRADIENTS/ REYNOLDS NUMBER/ VISCOSITY/ WIND VELOCITY

ABA: A.T.S.

ABS: Flow over surface obstructions can produce adverse flying conditions for helicopters, V/STOL vehicles, etc. The disturbed boundary-layer concept is applied in approximating the localized flow field induced around a surface obstruction (modeled by a two-dimensional cylinder with elliptical cross section) by an impinging wind. The analysis concludes that: (1) localized wind-speed maxima occur at the top of a surface obstruction, which are expected in physically real flows; (2) increased elliptical aspect ratio decreases with speed within the boundary layer at the top of the ellipse; (3) increased surface roughness decreases velocity in the boundary layer; (4) Reynolds number has a negligible effect on the overall flow for the Re range considered; (5) decreased elliptical aspect ratio and increased surface roughness cause larger separation regions.

75A11114*# ISSUE 1 PAGE 9 CATEGORY 5 RPT#: AIAA PAPER 74-1277 74/10/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: The rotor systems research aircraft - A flying wind tunnel

AUTH: A/LINDEN, A. W.; B/HELLYAR, M. W. PAA: B/(United Aircraft Corp., Sikorsky Aircraft Div., Stratford, Conn.)

Canadian Aeronautics and Space Institute and American Institute of Aeronautics and Astronautics, Joint Meeting, Toronto, Canada, Oct. 30, 31, 1974, AIAA 11 p. NASA-Army-supported research.

MAJS: /*ESCAPE SYSTEMS/*FLIGHT TEST VEHICLES/*HELICOPTER PERFORMANCE/*RESEARCH AIRCRAFT/*ROTARY WING AIRCRAFT

MINS: / AIRCRAFT CONFIGURATIONS/ COMPOUND HELICOPTERS/ FIXED WINGS/ ROTOR AERODYNAMICS/ S-61 HELICOPTER/ WIND TUNNELS

ABA: (Author)

ABS: The Sikorsky Aircraft division of United Aircraft

Corporation is constructing two uniquely designed Rotor Systems Research Aircraft (RSRA). These aircraft will be used through the 1980's to comparatively test many different types of rotors - articulated, hingeless, teetering, and gimballed, as well as advanced rotor concepts, such as reverse velocity and variable diameter rotors. The RSRA combines a new airframe with existing Sikorsky H-3 (S-61) dynamic components. A force measurement system is incorporated to permit accurate evaluation of significant rotor characteristics. Both rotor and fixed-wing control systems are provided, appropriately integrated for operation in the pure helicopter mode, compound helicopter mode, and fixed-wing mode. The RSRA is the first rotary wing aircraft designed with a crew escape system, including a pyrotechnic system to sever the main rotor blades.

74A37541*# ISSUE 18 PAGE 2542 CATEGORY 2
74/04/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: The noise environment of a school classroom due to the operation of utility helicopters

AUTH: A/HILTON, D. A.; B/PEGG, R. J. PAA: B/(NASA, Langley Research Center, Hampton, Va.)

Accustical Society of America, Meeting, 87th, New York, N.Y., Apr. 23-26, 1974, Paper, 14 p.

MAJS: /*AIRCRAFT NOISE/*ENVIRONMENTAL TESTS/*HELICOPTERS/* NOISE POLLUTION

MINS: / ACOUSTIC MEASUREMENT/ AMBIENCE/ HUMAN TOLERANCES/ NOISE REDUCTION/ POLICE/ UTILITY AIRCRAFT

74A37507*# ISSUE 18 PAGE 2639 CATEGORY 32
CNT#: NAS2-7245 74/00/00 17 PAGES UNCLASSIFIED DOCUMENT

UTTL: Hingeless rotor theory and experiment on vibration reduction by periodic variation of conventional controls

AUTH: A/SISSINGH, G. J.; B/DONHAM, R. E. PAA: B/(Lockheed-California Co., Burbank, Calif.)

In: Specialists Meeting on Rotorcraft Dynamics, Moffett Field, Calif., February 13-15, 1974, Proceedings. (A74-37481 18-02) Moffett Field, Calif., NASA Ames Research Center, 1974. 17 p.

MAJS: /*PERIODIC VARIATIONS/*RIGID ROTORS/*ROTOR AERODYNAMICS/*ROTOR BLADES/*STRUCTURAL VIBRATION/* VIBRATION DAMPING

MINS: / FLAPPING/ FREQUENCY RESPONSE/ HELICOPTER DESIGN/ MATHEMATICAL MODELS/ PITCHING MOMENTS/ ROLLING MOMENTS

ABA: F.R.L.

ABS: A preliminary evaluation is made of the concept of vibration reduction by properly selected oscillatory collective and cyclic control applications. The investigations are based on experimental frequency response data covering advance ratios from approximately 0.2 to 0.85. Because there was no instrumentation for the measurement of the pitch and roll vibrations, these values were obtained by properly adding up the flap-bending moments at 3.3 in. Any other quantity representing pitch/roll vibrations can be compensated for in the same fashion. The calculated control inputs required for vibration reduction stay within acceptable limits. For four of the five conditions tested they are smaller than the values used for the frequency response tests. As to be expected, the compensating controls greatly affect the blade loads, i.e., torsion, flap- and chordwise bending.

74A37504*# ISSUE 18 PAGE 2540 CATEGORY 2
74/00/00 6 PAGES UNCLASSIFIED DOCUMENT

UTTL: Multicyclic jet-flap control for alleviation of helicopter blade stresses and fuselage vibration

AUTH: A/MCCLOUD, J. L., III; B/KRETZ, M. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.); B/(NASA, Ames Research Center, Moffett Field, Calif.; Giravions Dorand, Suresnes, Hauts-de-Seine, France)

In: Specialists Meeting on Rotorcraft Dynamics, Moffett Field, Calif., February 13-15, 1974, Proceedings. (A74-37481 18-02) Moffett Field, Calif., NASA Ames Research Center, 1974. 6 p.

MAJS: /*FORCED VIBRATION/*FUSELAGES/*JET FLAPS/*ROTARY WINGS /*VIBRATORY LOADS/*WIND TUNNEL TESTS

MINS: / BENDING VIBRATION/ HELICOPTER CONTROL/ OPTIMAL CONTROL/ ROTOR AERODYNAMICS/ ROTOR BLADES/ STRESS CONCENTRATION/ STRESS CYCLES/ TRANSFER FUNCTIONS/ VERTICAL TAKEOFF AIRCRAFT

ABA: (Author)

ABS: Results of wind tunnel tests of a 12-meter-diameter rotor utilizing multicyclic jet-flap control deflection are presented. Analyses of these results are shown, and experimental transfer functions are determined by which optimal control vectors are developed. These vectors are calculated to eliminate specific harmonic bending stresses, minimize rms levels (a measure of the peak-to-peak stresses), or minimize vertical vibratory loads that would be transmitted to the fuselage. Although the specific results and the ideal control vectors presented are for a specific jet-flap driven rotor, the method employed for the analyses is applicable to similar investigations. A discussion of possible alternative methods of multicyclic control by mechanical flaps or nonpropulsive jet-flaps is presented.

74A37497*# ISSUE 18, PAGE 2540 CATEGORY 2
74/00/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Theory and comparison with tests of two full-scale proprotors

AUTH: A/JOHNSON, W. PAA: A/(NASA, Langley Research Center, Large-Scale Aerodynamics Branch; U.S. Army, Air Mobility R & D Laboratory, Moffett Field, Calif.)
In: Specialists Meeting on Rotorcraft Dynamics, Moffett Field, Calif., February 13-15, 1974, Proceedings. (A74-37481 18-02) Moffett Field, Calif., NASA Ames Research Center, 1974. 11 p.

MAJS: /*FULL SCALE TESTS/*MATHEMATICAL MODELS/*ROTOR AERODYNAMICS/*TILTING ROTORS

MINS: / DEGREES OF FREEDOM/ GIMBALS/ HELICOPTER DESIGN/ ROTARY WINGS/ ROTOR BLADES/ ROTORCRAFT AIRCRAFT

ABA: (Author)

ABS: A nine-degrees-of-freedom theoretical model has been developed for investigations of the dynamics of a prop rotor operating in high inflow axial flight on a cantilever wing. The theory is described, and the results of the analysis are presented for two prop rotor configurations: a gimbaled, stiff in-plane rotor, and a hingeless, soft in-plane rotor. The influence of various elements of the theory is discussed, including the modeling used for the blade and wing aerodynamics and the influence of the rotor lag degree of freedom. The results from full-scale tests of these two prop rotors are presented and compared with the theoretical results.

74A37496*# ISSUE 18 PAGE 2540 CATEGORY 2
74/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: An application of Floquet theory to prediction of mechanical instability --- for helicopter with inoperative blade damper

AUTH: A/HAMMOND, C. E. PAA: A/(U.S. Army, Air Mobility R & D Laboratory, Fort Eustis; NASA, Langley Research Center, Hampton, Va.)
In: Specialists Meeting on Rotorcraft Dynamics, Moffett Field, Calif., February 13-15, 1974, Proceedings (A74-37481 18-02) Moffett Field, Calif., NASA Ames Research Center, 1974. 12 p.

MAJS: /*AIRCRAFT STABILITY/*FLOQUET THEOREM/*HELICOPTER DESIGN/*HUBS/*ROTOR AERODYNAMICS

MINS: / ANISOTROPIC MEDIA/ EQUATIONS OF MOTION/ MATRIX METHODS/ MODAL RESPONSE/ ROTOR BLADES/ TIME RESPONSE/ VIBRATION DAMPING/ VIBRATION MODE

ABA: (Author)

ABS: The problem of helicopter mechanical instability is considered for the case where one blade damper is inoperative. It is shown that, if the hub is considered to be nonisotropic, the equations of motion have periodic coefficients which cannot be eliminated. However, if the hub is isotropic, the equations can be transformed to a rotating frame of reference and the periodic coefficients eliminated. The Floquet transition matrix method is shown to be an effective way of dealing with the nonisotropic hub and nonisotropic rotor situation. Time history calculations are examined and shown to be inferior to the Floquet technique for determining system stability.

74A37486*# ISSUE 18 PAGE 2539 CATEGORY 2
74/00/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Some approximations to the flapping stability of helicopter rotors

AUTH: A/BIGGERS, J. C. PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)
In: Specialists Meeting on Rotorcraft Dynamics, Moffett Field, Calif., February 13-15, 1974, Proceedings. (A74-37481 18-02) Moffett Field, Calif., NASA Ames Research Center, 1974. 9 p.

MAJS: /*AERODYNAMIC STABILITY/*AIRCRAFT STABILITY/*FLAPPING/*HELICOPTER DESIGN/*ROTARY WINGS

MINS: / APPROXIMATION/ FLIGHT CHARACTERISTICS/ FLOQUET THEOREM/ HOVERING STABILITY/ MATHEMATICAL MODELS/ MATRICES (MATHEMATICS)/ PERTURBATION THEORY

ABA: (Author)

ABS: The flapping equation for a helicopter in forward flight has coefficients which are periodic in time, and this effect complicates the calculation of stability. This paper presents a constant coefficient approximation which will allow the use of all the well known methods for analyzing constant coefficient equations. The flapping equation is first transformed into the nonrotating coordinate frame, where some of the periodic coefficients are transformed into constant terms. The constant coefficient approximation is then made by using time averaged coefficients in the nonrotating frame. Stability calculations based on the approximation are compared to results from a theory which correctly includes all of the periodicity. The comparison indicates that the approximation is reasonably accurate at advance ratios up to 0.5.

74A37481* ISSUE 18 PAGE 2538 CATEGORY 2
74/00/00 386 PAGES UNCLASSIFIED DOCUMENT

UTTL: Specialists Meeting on Rotorcraft Dynamics, Moffett Field, Calif., February 13-15, 1974. Proceedings Meeting sponsored by the American Helicopter Society and NASA, Moffett Field, Calif., NASA Ames Research Center, 1974. 386 p.

MAJS: /*CONFERENCES/*HELICOPTER DESIGN/*ROTOR AERODYNAMICS/*

ROTORCRAFT AIRCRAFT .

MINS: / AERODYNAMIC STALLING/ AEROELASTICITY/ AIRFRAMES/ COMPLEX SYSTEMS/ FINITE ELEMENT METHOD/ FLAPPING/ FORCED VIBRATION/ FREE VIBRATION/ ROTOR BLADES/ TORSIONAL VIBRATION

ABA: J.K.K.

ABS: Analysis of specific problems in rotorcraft dynamics. Topics include hingeless rotor theory, dynamic stall modelling, periodic systems identification, analysis of complex systems with phasing matrices, flapping stability, flap-lag dynamics at high advance ratios, finite element analysis and fuselage free-vibration characteristics, coupled rotor/frame vibration methods, gust response characteristics with unsteady stall effects, antiresonance theory, cyclic feathering motions and dynamic loads, control load envelope shaping, rotor aeroelasticity, use of Floquet theory, theory of proprotors and tilt-rotors, two-bladed teetering rotors, stability of air and ground resonance, vertical-plane pendulum absorbers, multicyclic jet-flap control, engine/frame interface dynamics, and others. The minutes of the question and answer periods following the presentations are presented in the supplement. Individual items are announced in this issue.

74A36615* ISSUE 17 PAGE 2376 CATEGORY 2 RPT#: AHS PREPRINT 801 74/05/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: The prediction of rotor rotational noise using measured fluctuating blade loads

AUTH: A/HOSIER, R. N.; B/PEGG, R. J.; C/RAMAKRISHNAN, R. PAA: A/(U.S. Army, Air Mobility Research and Development Laboratory, Hampton, Va.); B/(NASA, Langley Research Center, Hampton, Va.)
American Helicopter Society, Annual National V/STOL Forum, 30th, Washington, D.C., May 7-9, 1974, 14 p.

MAJS: /*ACOUSTIC MEASUREMENT/*AIRCRAFT NOISE/*FAR FIELDS/*HELICOPTER DESIGN/*PERFORMANCE PREDICTION/*ROTOR BLADES

MINS: / AERODYNAMIC NOISE/ DATA REDUCTION/ NOISE GENERATORS/ NOISE SPECTRA/ ROTOR AERODYNAMICS/ TEST FACILITIES

ABA: (Author)

ABS: In tests conducted at the NASA Langley Research Center Helicopter Rotor Test Facility, simultaneous measurements of the high-frequency fluctuating aerodynamic blade loads and far-field radiated noise were made on a full-scale, nontranslating rotor system. After their characteristics were determined, the measured blade loads were used in an existing theory to predict the far-field rotational noise. A comparison of the calculated and measured rotational noise is presented with specific attention given to the effect of blade loading coefficients, chordwise loading distributions, blade loading phases, and observer azimuthal position on the predictions.

74A36614* ISSUE 17 PAGE 2433 CATEGORY 14 RPT#: AHS PREPRINT 800 74/05/00 8 PAGES UNCLASSIFIED DOCUMENT

UTTL: Laser velocimeter measurements of the helicopter rotor-induced flow field

AUTH: A/BIGGERS, J. C.; B/ORLOFF, K. L. PAA: B/(NASA, Ames Research Center, Moffett Field, Calif.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00
American Helicopter Society, Annual National V/STOL Forum, 30th, Washington, D.C., May 7-9, 1974, 8 p.

MAJS: /*FLOW VELOCITY/*HELICOPTER WAKES/*LASER DOPPLER VELOCIMETERS/*ROTARY WINGS/*WIND TUNNEL TESTS

MINS: / AERODYNAMIC LOADS/ FLOW MEASUREMENT/ SIGNAL PROCESSING/ VELOCITY MEASUREMENT/ VORTICES/ WIND TUNNEL MODELS

ABA: (Author)

ABS: The use of a two-color laser velocimeter to measure the flow velocities in the wake of a helicopter rotor is discussed, including methods for obtaining two components of both instantaneous and time-averaged velocities. Results are presented from an experiment using a 2.13 m diameter model helicopter rotor operating at a tip speed ratio of 0.18 in a wind tunnel. The location of the tip vortex from the preceding blade was determined on the advancing side, and the diameter of the vortex core was found to be 15 percent of the blade chord (1.5 percent of the radius). The effects of the airfoil's bound vorticity were observed in the velocity distributions very near the blade. These effects suggest that the laser velocimeter may be used to determine the aerodynamic loading (circulation) at a spanwise station on the blade. Also, the structure and boundary of the time-averaged wake were investigated.

74A36610* ISSUE 17 PAGE 2376 CATEGORY 2 RPT#: AHS PREPRINT 880 CNT#: NAS1-11688 74/05/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of advanced composites to helicopter airframe structures --- CH-53 D materials

AUTH: A/RICH, M. J.; B/RIDGLEY, G. F.; C/LOWRY, D. W. PAA: C/(United Aircraft Corp., Sikorsky Aircraft Div., Stratford, Conn.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00
American Helicopter Society, Annual National V/STOL Forum, 30th, Washington, D.C., May 7-9, 1974, 9 p.

MAJS: /*AIRFRAME MATERIALS/*COMPOSITE MATERIALS/*FUSELAGES/*HELICOPTER DESIGN

MINS: / BORON/ COST ESTIMATES/ EPOXY RESINS/ GRAPHITE/ H-53 HELICOPTER/ REINFORCED PLASTICS/ SKIN (STRUCTURAL MEMBER)/ STRINGERS

ABA: P.T.H.

ABS: The present work outlines a study whose objective was to assess the possible use of advanced composite materials to nellcopter fuselage structure. The study used the CH-53D as a baseline design for comparison of composite with current conventional construction. Boron/epoxy and graphite/epoxy appeared to be the prime candidate materials for the major portion of the primary structure, while Kevlar-49/epoxy was the prime candidate material for secondary structure. A single-laminate shear-carrying skin combined with stringers and frames in an all-molded construction was considered the most promising concept for the airframe shell construction; foam-stabilized graphite/epoxy stringer was considered the prime concept for stringer construction. Shell construction and assembly concepts are discussed, and comparison of weight and material between current CH-53D airframe and the composite airframe shows that the latter may represent an 18% weight saving. Based on a fleet requirement of 600 venicles, the operating cost for a fleet of helicopters constructed with the composite material airframe flying 500 hours a year per aircraft over a ten-year service life was calculated, indicating a $337,000 saving per helicopter.

74A36602* ISSUE 17 PAGE 2386 CATEGORY 5 RPT#: AHS PREPRINT 862 74/05/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter flight investigation to determine the effects of a closed-circuit TV on performance of a precision sling-load handling task

AUTH: A/DICARLO, D. J.; B/KELLEY, H. L.; C/SPIVEY, D. L. PAA: A/(NASA, Langley Research Center, Hampton, Va.); B/(U.S. Army, Air Mobility Research and Development Laboratory, Hampton, Va.); C/(U.S. Army, Fort Eustis, Va.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00 American Helicopter Society, Annual National V/STOL Forum, 30th, Washington, D.C., May 7-9, 1974, 13 p.

MAJS: /*CLOSED CIRCUIT TELEVISION/*DISPLAY DEVICES/*FLIGHT TESTS/*HEAVY LIFT HELICOPTERS/*HELICOPTER PERFORMANCE /*PILOT PERFORMANCE

MINS: / AIRCRAFT STABILITY/ ERROR ANALYSIS/ LOAD TESTS/ TABLES (DATA)/ TELEVISION SYSTEMS

ABA: (Author)

ABS: Helicopter sling-load operations have been limited during hover and low-speed flight by the degree of precision achieved by the pilot/helicopter/sling-load combination. Previous attempts to improve precision have included stabilization of the load and helicopter and the addition of a pilot station directly facing the load. In these tests, use of a closed-circuit TV as a display that would permit sling-load delivery and placement by the forward-facing pilot was evaluated using a CH-54B helicopter. In all, three test cases were documented, which included the following: (1) forward-facing pilot using the TV display, (2) forward-facing pilot using verbal commands from a load-facing observer, and (3) aft-facing pilot using direct visual cues. The results indicate that a comparable level of performance was achieved for each test case; however, an increase in pilot workload was noted when the TV system was used.

74A36586* ISSUE 17 PAGE 2374 CATEGORY 2 RPT#: AHS PREPRINT 831 CNT#: NAS2-7613 74/05/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: On the use of first order rotor dynamics in multiblade coordinates --- for compound helicopter

AUTH: A/HOHENEMSER, K. H.; B/YIN, S. K. PAA: B/(Washington University, St. Louis, Mo.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00 American Helicopter Society, Annual National V/STOL Forum, 30th, Washington, D.C., May 7-9, 1974, 15 p.

MAJS: /*COMPOUND HELICOPTERS/*FLIGHT STABILITY TESTS/* HELICOPTER CONTROL/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / ANALYSIS (MATHEMATICS)/ DYNAMIC MODELS/ EIGENVALUES/ FEEDBACK CONTROL/ FLAPPING/ FLIGHT MECHANICS/ LINEAR SYSTEMS/ PITCH (INCLINATION)/ RIGID ROTORS/ ROLL/ TRANSIENT RESPONSE/ VERTICAL MOTION

ABA: (Author)

ABS: This paper is directed to the question of how to represent most efficiently rotor/body coupling in a linear flight dynamics analysis. Rigid body pitch, roll and vertical motions are considered for the rotor/body coupling studies. Flapping stability limits, eigenvalues, transient responses to control step inputs, to step gusts and to random gusts are determined for a hypothetical hingeless compound helicopter operating up to .8 advance ratio. Data are obtained for the basic helicopter and for the craft with two simple control feedback systems. While complete periodic system modeling is necessary for determining flapping stability limits and vibrations, constant system modeling using first order dynamics in each of the multiblade rotor coordinates was found to be adequate for rotor-craft stability and response computations.

74A26713*# ISSUE 11 PAGE 1478 CATEGORY 2 RPT#: AIAA PAPER 74-417 CNT#: NGR-05-007-414 74/04/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Aeroelastic stability of periodic systems with application to rotor blade flutter

AUTH: A/FRIEDMANN, P.; B/SILVERTHORN, L. J. PAA: B/(California, University, Los Angeles, Calif.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00

AIAA, ASME, and SAE, Structures, Structural Dynamics and Materials Conference, 15th, Las Vegas, Nev., Apr. 17-19, 1974, AIAA 11 p.

MAJS: /*AEROELASTICITY/*AIRCRAFT STABILITY/*FLUTTER ANALYSIS /*HELICOPTER DESIGN/*ROTOR BLADES

MINS: / DIFFERENTIAL EQUATIONS/ DYNAMIC STRUCTURAL ANALYSIS/ ERROR ANALYSIS/ FLOQUET THEOREM/ LIAPUNOV FUNCTIONS/ LINEAR EQUATIONS/ NUMERICAL STABILITY/ STEP FUNCTIONS

ABA: (Author)

ABS: The dynamics of a helicopter blade in forward flight are described by a system of linear differential equations with periodic coefficients. The stability of this periodic aeroelastic system is determined, using multivariable Floquet-Liapunov theory. The transition matrix at the end of the period is evaluated by: (1) direct numerical integration, and (2) a new, approximate method, which consists in approximating a periodic function by a series of step functions. The numerical accuracy and efficiency of the methods is compared, and the second method is shown to be superior by far. Results illustrating the effect of the periodic coefficients and various blade parameters are presented.

74A22472* ISSUE 9 PAGE 1166 CATEGORY 2 73/00/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: The role of wind tunnel testing in the development of advanced rotary-wing aircraft

AUTH: A/KELLY, M. W. PAA: A/(NASA, Ames Research Center, Large Scale Aerodynamics Branch, Moffett Field, Calif.)

In: Status of testing and modeling techniques for V/STOL aircraft; Proceedings of the Mideast Region Symposium, Essington, Pa., October 26-28, 1972. (A74-22451 09-02) Philadelphia, Pa., Boeing Vertol Co., 1973. 18 p.

MAJS: /*ROTARY WING AIRCRAFT/*SCALE MODELS/*TILTING ROTORS/* WIND TUNNEL TESTS

MINS: / AIRCRAFT DESIGN/ AIRCRAFT MODELS/ COST ANALYSIS/ DYNAMIC MODELS/ FIXED WINGS/ TEST FACILITIES

ABA: M.V.E.

ABS: The relations of wind tunnel test objectives to wind tunnel test requirements are reviewed in an assessment of the current role of wind tunnel testing in the development of advanced rotary-wing aircraft. Elements of typical development programs are examined, and a comparison of fixed wing and rotary wing aircraft programs is presented. Proposed new test facilities for fixed wing aircraft and typical aircraft program costs are discussed, along with the use of wind tunnels for tilt rotor research aircraft and the role of 40 x 80 ft wind tunnels in tilt rotor aircraft development. Some changes in current programs and methods are outlined for bringing about desired improvements.

74A22470* ISSUE 9 PAGE 1161 CATEGORY 1 73/00/00 25 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotating-blade vortex noise

AUTH: A/SCHEIMAN, J.; B/LETKO, W.; C/SHIVERS, J. P.; D/HILTON, D. A. PAA: D/(NASA, Langley Research Center, Hampton, Va.)

In: Status of testing and modeling techniques for V/STOL aircraft; Proceedings of the Mideast Region Symposium, Essington, Pa., October 26-28, 1972. (A74-22451 09-02) Philadelphia, Pa., Boeing Vertol Co., 1973. 25 p.

MAJS: /*ACOUSTIC MEASUREMENT/*AERODYNAMIC NOISE/*NOISE SPECTRA/*ROTOR BLADES/*VORTICES/*WIND TUNNEL TESTS

MINS: / AIRFOIL PROFILES/ BLADE TIPS/ FREQUENCY DISTRIBUTION / FULL SCALE TESTS/ HELICOPTER WAKES/ ROTARY WINGS/ TURBULENT WAKES

ABA: (Author)

ABS: An experimental investigation has been made of the Langley full-scale tunnel and outdoors to investigate some of the characteristics of vortex noise generated on a rotating-blade system. Acoustic measurements were made at several microphone positions for two different blade sections with several tip shapes and spoiler configurations. The blades were operated only at zero lift at each radial station, both for operating in their own wake and for operating with the wake blown downstream. Rotors with cylindrical blades generally created more noise throughout the noise spectrum than the rotor with NACA 0012 blades. Blowing the shed wake from the rotor with cylindrical blades did not have an appreciable effect on the frequency-amplitude spectrum. The tip shape changes had very little effect on the frequency-amplitude spectrum of the noise. Spoilers applied to the rotor with NACA 0012 blades increased the amplitude of the spectrum and decreased the number of harmonics of blade passage frequency.

74A22468* ISSUE 9 , PAGE 1166 CATEGORY 2
73/00/00 31 PAGES UNCLASSIFIED DOCUMENT

UTTL: A comparison of the noise characteristics of full scale and model helicopter rotors

AUTH: A/LEVERTON, J. W.; B/POLLARD, J. S. PAA: B/(Westland Helicopters, Ltd., Yeovil, Somerset, England)

In: Status of testing and modeling techniques for V/STOL aircraft; Proceedings of the Mideast Region Symposium, Essington, Pa., October 26-28, 1972. (A74-22451 09-02) Philadelphia, Pa., Boeing Vertol Co., 1973. 31 p. Research supported by the Ministry of Defence and NASA.

MAJS: /*AERODYNAMIC NOISE/*FULL SCALE TESTS/*NOISE SPECTRA/*ROTARY WINGS/*ROTOR AERODYNAMICS/*SCALE MODELS

MINS: / ACOUSTIC MEASUREMENT/ AIRCRAFT NOISE/ BLADE TIPS/ HELICOPTER PERFORMANCE/ PITCH (INCLINATION)/ THRUST

ABA: (Author)

ABS: Full scale and model rotor noise results are compared in terms of the spectral content, the directivity patterns, and the dependence on tip speed and rotor thrust/pitch angle. Each of the three main noise sources (rotational, low-frequency broadband, and high-frequency broadband) are reviewed separately, and account is taken of the measurement angle relative to the rotor disc. Blade 'scaling' effects are discussed together with the agreement between existing theoretical and semiempirical prediction methods. It is shown that in general good agreement is obtained between the full scale and model rotors for the spectral content and the velocity and thrust dependencies, while the 'scaling' factors associated with the low-frequency broadband noise do not seem to be appropriate.

74A22464* ISSUE 9 PAGE 1165 CATEGORY 2
73/00/00 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: Studies of a large-scale jet-flap rotor in the 40- by 80-foot wind tunnel

AUTH: A/MCCLOUD, J. L., III PAA: A/(NASA, Ames Research Center, Moffett Field, Calif.)

In: Status of testing and modeling techniques for V/STOL aircraft; Proceedings of the Mideast Region Symposium, Essington, Pa., October 26-28, 1972. (A74-22451 09-02) Philadelphia, Pa., Boeing Vertol Co., 1973. 18 p.

MAJS: /*HELICOPTER CONTROL/*JET FLAPS/*ROTOR AERODYNAMICS/*SCALE MODELS/*VIBRATORY LOADS/*WIND TUNNEL TESTS

MINS: / AEROELASTICITY/ DYNAMIC TESTS/ ROTARY WINGS/ VIBRATIONAL STRESS

ABA: M.V.E.

ABS: Description of a large scale rotor and its apparatus which were constructed to investigate the merits of jet-flap applications to helicopter rotors. The presented results of a wind-tunnel study, aimed at determining the jet-flap multicyclic control potential for vibratory load and stress relief, illustrate the types of control deflections involved and their effects. A demonstrated analysis technique, which is used to analyze these results, is believed to be applicable to many kinds of investigations, particularly where large numbers of variables are involved and where circumstances tend to preclude 'systematic' testing. Among the major results of the study is the finding that significant and substantial vibratory stress and load reductions are achievable with a jet-flap multicyclic control system.

74A18140*# ISSUE 6 PAGE 733 CATEGORY 1 CNT#: NAS2-4151 73/12/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: An unsteady wake model for a hingeless rotor

AUTH: A/CREWS, S. T.; B/HOHENEMSER, K. H.; C/ORMISTON, R. A. PAA: B/(Washington University, St. Louis, Mo.); C/(U.S. Army, Air Mobility Research and Development Laboratory, Moffett Field, Calif.)

Journal of Aircraft, vol. 10, Dec. 1973, p. 758-760.

MAJS: /*HELICOPTER WAKES/*MATHEMATICAL MODELS/*MOMENTUM THEORY/*RIGID ROTORS

MINS: / DYNAMIC MODELS/ FOURIER TRANSFORMATION/ STEADY STATE

ABA: M.V.E.

ABS: A simple nonsteady wake model derived from the unsteady moment of the momentum equation for zero advance ratio is correlated with cyclic pitch frequency response tests conducted with a small hingeless rotor model. Two and three or more bladed rotor analyses are presented.

74A17810*# ISSUE 6 PAGE 793 CATEGORY 14
73/12/00 10 PAGES UNCLASSIFIED DOCUMENT

UTTL: Airborne profiling of ice thickness using a short pulse radar

AUTH: A/VICKERS, R. S.; B/HEIGHWAY, J. E.; C/GEDNEY, R. T. PAA: A/(Colorado State University, Fort Collins, Colo.); C/(NASA, Lewis Research Center, Cleveland, Ohio)

Interdisciplinary Symposium on Advanced Concepts and Techniques in the Study of Snow and Ice Resources, Monterey, Calif., Dec 2-6, 1973. Paper. 10 p.

MAJS: /*AIRBORNE EQUIPMENT/*ICE REPORTING/*PULSE RADAR/*RADAR MEASUREMENT/*THICKNESS

MINS: / DATA SAMPLING/ GROUND TRUTH/ HELICOPTERS/ RADAR DATA / SURFACE ROUGHNESS/ TRAVELING WAVE TUBES

ABA: (Author)

ABS: This paper describes helicopter-borne measurements of ice thickness in Lake Superior, Lake St. Clair, and

the St. Clair river as part of NASA's program to develop an ice information system. The profiler described is a high resolution, nonimaging, short pulse radar, operating at a carrier frequency of 2.7 GHz. The system can resolve reflective surfaces separated by as little as 10 cm and permits measurement of the distance between resolvable surfaces with an accuracy of about 1 cm. Data samples are given for measurements both in a static (helicopter hovering), and a traverse mode. Ground truth measurements taken by an ice auger team traveling with the helicopter are compared with the remotely sensed data and the accuracy of the profiler is discussed based on these measurements.

74A11844* ISSUE 2 PAGE 164 CATEGORY 2 CNT#: NAS2-6175 73/10/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Some conclusions regarding the aeroelastic stability of hingeless helicopter blades in hover and in forward flight

AUTH: A/FRIEDMANN, P. PAA: A/(California, University, Los Angeles, Calif.)

American Helicopter Society, Journal, vol. 18, Oct. 1973, p. 13-23.

MAJS: /*AEROELASTICITY/*AIRCRAFT STABILITY/*HELICOPTER DESIGN/*HOVERING STABILITY/*RIGID ROTORS/*ROTOR BLADES

MINS: / ASYMPTOTIC SERIES/ EQUATIONS OF MOTION/ FLAPS (CONTROL SURFACES)/ ROTARY WINGS/ TORSIONAL STRESS

ABA: (Author)

ABS: In this paper results and conclusions obtained from the study of the aeroelastic instability of hingeless helicopter blades are presented. First, the large amplitude coupled flap-lag equations of motion of a hingeless elastic helicopter blade are solved using an asymptotic expansion procedure in multiple time scales. Both hover and forward flight cases are considered. Stability boundaries and amplitudes of nonlinear response are obtained. From these, the importance of the nonlinear coupling and the effect of the periodic coefficients is determined. Next, using a system of linearized coupled flap-lag-pitch equations in hover, various divergence mechanisms for hingeless blades are shown. Finally, the flutter boundaries for coupled flap-lag-pitch are obtained. The effect of the torsional degree of freedom on the flap-lag type of instability is investigated. Similarly the effect of lag on the flap-pitch type of instability is considered. In addition, the effect of various blade parameters on the stability boundaries is shown.

73A45264* ISSUE 24 PAGE 3057 CATEGORY 2 73/09/22 18 PAGES UNCLASSIFIED DOCUMENT

UTTL: A comparison of the overall and broadband noise characteristics of full-scale and model helicopter rotors.

AUTH: A/LEVERTON, J. W.; B/POLLARD, J. S. PAA: B/(Westland Helicopters, Ltd., Yeovil, Somerset, England)

Journal of Sound and Vibration, vol. 30, Sept. 22, 1973, p. 135-152. Research supported by the Ministry of Defence and NASA.

MAJS: /*AERODYNAMICS/*AIRCRAFT NOISE/*BROADBAND/*FULL SCALE TESTS/*NOISE SPECTRA/*ROTARY WINGS

MINS: / DIRECTIVITY/ HELICOPTER DESIGN/ NOISE GENERATORS/ SCALE MODELS/ SOUND PRESSURE

ABA: (Author)

ABS: The broadband noise generated by full-scale and model rotors is compared in terms of spectral content and the dependence on tip speed and rotor thrust/pitch angle. Low frequency broadband noise and high frequency broadband noise are studied separately and blade 'scaling' effects are outlined. The degree of agreement between measurements and theoretical and semi-empirical prediction methods is reviewed together with the directionality patterns. The parameters relating to the overall noise are also discussed. It is shown that in general good agreement is obtained between the full-scale and model rotors when considering spectral content and the dependency of the noise levels on tip speed and thrust. The scaling factors usually considered applicable to the low frequency broadband noise do not, however, appear to apply to either the model or full scale rotors.

73A43134* ISSUE 22 PAGE 2800 CATEGORY 2 CNT#: NAS2-6175 73/09/08 23 PAGES UNCLASSIFIED DOCUMENT

UTTL: Non-linear flap-lag dynamics of hingeless helicopter blades in hover and in forward flight.

AUTH: A/FRIEDMANN, P.; B/ ONG, P. PAA: A/(California, University, Los Angeles, Calif.); B/(MIT, Cambridge, Mass.)

Journal of Sound and Vibration, vol. 30, Sept. 8, 1973, p. 9-31.

MAJS: /*AERODYNAMIC STABILITY/*AEROELASTICITY/*HOVERING/*RIGID ROTORS/*ROTARY WINGS/*ROTOR AERODYNAMICS

MINS: / CRITICAL LOADING/ FLAPPING HINGES/ HELICOPTER PERFORMANCE/ NONLINEAR EQUATIONS

ABA: (Author)

ABS: The aeroelastic instability of the coupled nonlinear flap-lag motion of a torsionally rigid helicopter blade is treated by using the perturbation method in multiple time scales. The nonlinearities present in the equations are those arising from the inclusion of

moderately large deflections in the inertia and aerodynamic loading terms. The stability boundaries, amplitudes of nonlinear response, and conditions for existence of limit cycles are obtained analytically. Thus the different roles played by the forcing, parametric excitation, and nonlinear coupling in affecting the solution can be easily identified. Numerical results illustrating the behavior of the blade are presented.

73A35088* ISSUE 17 PAGE 2248 CATEGORY 32 RPT#: AHS PREPRINT 770 73/05/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: Elastohydrodynamic principles applied to the design of helicopter components.

AUTH: A/TOWNSEND, D. P. PAA: A/(NASA, Lewis Research Center, Cleveland, Ohio) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00

American Helicopter Society, Annual National Forum, 29th, Washington, D.C., May 9-11, 1973, 11 p.

MAJS: /*ELASTOHYDRODYNAMICS/*HELICOPTER DESIGN/*HELICOPTER PROPELLER DRIVE/*LUBRICATION

MINS: / BALL BEARINGS/ COMPONENT RELIABILITY/ FILM THICKNESS/ GEARS/ POWER TRANSMISSION/ SERVICE LIFE/ SLIDING FRICTION/ SURFACE ROUGHNESS/ SURFACE TEMPERATURE/ TEMPERATURE EFFECTS

ABA: (Author)

ABS: Elastohydrodynamic principles affecting the lubrication of transmission components are presented and discussed. Surface temperatures of the transmission bearings and gears affect elastohydrodynamic film thickness. Traction forces and sliding as well as the inlet temperature determine surface temperatures. High contact ratio gears cause increased sliding and may run at higher surface temperatures. Component life is a function of the ratio of elastohydrodynamic film thickness to composite surface roughness. Lubricant starvation reduces elastohydrodynamic film thickness and increases surface temperatures. Methods are presented which allow for the application of elastohydrodynamic principles to transmission design in order to increase system life and reliability.

73A35075* ISSUE 17 PAGE 2209 CATEGORY 21 RPT#: AHS PREPRINT 742 73/05/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: A manual-control approach to development of VTOL automatic landing technology.

AUTH: A/KELLY, J. R.; B/NIESSEN, F. R.; C/GARREN, J. F., JR. PAA: C/(NASA, Langley Research Center, Hampton, Va.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00

American Helicopter Society, Annual National Forum, 29th, Washington, D.C., May 9-11, 1973, 12 p.

MAJS: /*AUTOMATIC LANDING CONTROL/*MANUAL CONTROL/*NAVIGATION AIDS/*VERTICAL TAKEOFF AIRCRAFT

MINS: / APPROACH CONTROL/ COMMAND AND CONTROL/ DECELERATION/ FLIGHT INSTRUMENTS/ HELICOPTER CONTROL/ PITCH (INCLINATION)

ABA: (Author)

ABS: The operation of VTOL aircraft in the city-center environment will require complex landing-approach trajectories that insure adequate clearance from other traffic and obstructions and provide the most direct routing for efficient operations. As part of a larger program to develop the necessary technology base, a flight investigation was undertaken to study the problems associated with manual and automatic control of steep, decelerating instrument approaches and landings. The study employed a three-cue flight director driven by control laws developed and refined during manual-control studies and subsequently applied to the automatic approach problem. The validity of this approach was demonstrated by performing the first automatic approach and landings to a predetermined spot ever accomplished with a helicopter. The manual-control studies resulted in the development of a constant-attitude deceleration profile and a low-noise navigation system.

73A35068* ISSUE 17 PAGE 2105 CATEGORY 2 RPT#: AHS PREPRINT 732 CNT#: NAS2-4151 73/05/00 15 PAGES UNCLASSIFIED DOCUMENT

UTTL: On the question of adequate hingeless rotor modeling in flight dynamics.

AUTH: A/HOHENEMSER, K. H.; B/YIN, S.-K. PAA: B/(Washington University, St. Louis, Mo.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00

American Helicopter Society, Annual National Forum, 29th, Washington, D.C., May 9-11, 1973, 15 p.

MAJS: /*AEROELASTICITY/*MODAL RESPONSE/*RIGID ROTORS/*ROTOR AERODYNAMICS/*ROTOR BLADES/*VIBRATION MODE

MINS: / AERODYNAMIC STABILITY/ ELASTIC PROPERTIES/ FLAPPING/ FLIGHT MECHANICS/ GUST LOADS/ HUBS

ABA: (Author)

ABS: The somewhat controversial question of which elastic blade modes are essential in the flight mechanics of hingeless rotorcraft is studied on the basis of quasi-steady linear aerodynamics including reversed flow effects and uniform inflow. The modes are for the rotating blade, and intermode aerodynamic coupling terms are retained. The criteria for judging elastic mode effects include 19 hub moment and force derivatives, rotor trim data, rotor stability charts for lagged hub moment feedback, step gust and random

gust responses. Fixed hub and constant chord blades with widely differing elasticity and inertia and with moderate twist are assumed.

73A30469* ISSUE 14 PAGE 1743 CATEGORY 11
73/04/00 4 PAGES UNCLASSIFIED DOCUMENT
UTTL: Meeting the challenge of advanced helicopters.
UNOC: Wind tunnel tests as part of rotary wing aircraft development, discussing technical and economic aspects
AUTH: A/KELLY, M. W. PAA: A/(NASA. Ames Research Center, Large-Scale Aerodynamics Branch, Moffett Field, Calif.)
Vertiflite, vol. 19, Mar.-Apr. 1973, p. 4-6, 8.
MAJS: /*ECONOMIC FACTORS/*ROTARY WING AIRCRAFT/*WIND TUNNEL TESTS
MINS: / AIRCRAFT DESIGN/ COST ESTIMATES/ FLIGHT TESTS/ FULL SCALE TESTS/ RESEARCH AND DEVELOPMENT/ RESEARCH FACILITIES/ SUBSONIC WIND TUNNELS/ WIND TUNNEL MODELS
ABA: F.R.L.
ABS: Wind tunnel tests that are conducted during the course of a typical aircraft development program are considered. The objectives of a test program are to reduce technical and financial risk and to improve product performance. Typical fixed-wing and rotary-wing aircraft development programs are compared. It is concluded that existing wind tunnel practice is not adequate in relation to the consequences from serious problems remaining undetected until flight test. In fact, the ultimate goal of the wind tunnel test program should leave nothing for the flight test program but the demonstration of the final product.

73A25533*# ISSUE 11 PAGE 1440 CATEGORY 32
RPT#: AIAA PAPER 73-404 CNT#: NGR-50-007-001
73/03/00 13 PAGES UNCLASSIFIED DOCUMENT
UTTL: Sensitivity of rotor blade vibration characteristics to torsional oscillations.
AUTH: A/BRATANOW, T.; B/ECER, A. PAA: B/(Wisconsin, University, Milwaukee, Wis.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00
AIAA, ASME, and SAE, Structures, Structural Dynamics, and Materials Conference, 14th, Williamsburg, Va., Mar. 20-22, 1973. AIAA 13 p.
MAJS: /*DEGREES OF FREEDOM/*DYNAMIC RESPONSE/*HELICOPTER DESIGN/*ROTOR BLADES/*TORSIONAL VIBRATION
MINS: / AERODYNAMIC LOADS/ BENDING VIBRATION/ VIBRATION DAMPING
ABA: (Author)
ABS: A theoretical investigation of dynamic response characteristics of helicopter rotor blades in forward flight was carried out with special emphasis on the torsional degrees-of-freedom. The finite element method was applied in the formulation of the coupled equations of motion for flapwise bending and torsion for blades with non-collinear elastic, mass and aerodynamic axes. The sensitivity of blade vibration characteristics with respect to structural, geometric and aerodynamic properties as well as flight conditions was evaluated. Numerical results for sample blades were plotted to show the variation of the coupling between bending and torsional components of the response.

73A24391* ISSUE 10 PAGE 1175 CATEGORY 2
73/02/08 28 PAGES UNCLASSIFIED DOCUMENT
UTTL: Scaling aircraft noise perception.
UNOC: Perceived level calculation methods for aircraft flyover noise scaling, rating jets, turboprops, piston aircraft and helicopters with frequency weighting functions, duration and tone corrections
AUTH: A/OLLERHEAD, J. B. PAA: A/(Loughborough University of Technology, Loughborough, Leics., England)
Journal of Sound and Vibration, vol. 26, Feb. 8, 1973, p. 361-388. FAA-NASA-supported research.
MAJS: /*AIRCRAFT NOISE/*EFFECTIVE PERCEIVED NOISE LEVELS/*HUMAN REACTIONS/*SCALING/*SENSORY PERCEPTION
MINS: / NOISE POLLUTION/ PITCH/ SOUND PRESSURE/ STATISTICAL CORRELATION/ TABLES (DATA)/ WEIGHTING FUNCTIONS
ABA: (Author)
ABS: Following a brief review of the background to the study, an extensive experiment is described which was undertaken to assess the practical differences between numerous alternative methods for calculating the perceived levels of individual aircraft flyover wounds. One hundred and twenty recorded sounds, including jets, turboprops, piston aircraft and helicopters were rated by a panel of subjects in a pair comparison test. The results were analyzed to evaluate a number of noise rating procedures, in terms of their ability to accurately estimate both relative and absolute perceived noise levels over a wider dynamic range (84-115 dB SPL) than had generally been used in previous experiments. Performances of the different scales were examined in detail for different aircraft categories, and the merits of different band level summation procedures, frequency weighting functions, duration and tone corrections were investigated.

73A21710* ISSUE 8 PAGE 961 CATEGORY 13 CNT#:
NASA ORDER R-03-038-002 72/00/00 17 PAGES
UNCLASSIFIED DOCUMENT

UTTL: The utility of a low flying aircraft or helicopter when collecting ground data for regional resource surveys.

AUTH: A/LAUER, D. T. PAA: A/(California, University, Berkeley, Calif.)
In: American Society of Photogrammetry and American Congress of Surveying and Mapping, Fall Convention, Columbus, Ohio, October 11-14, 1972, Proceedings. (A73-21701 08-14) Falls Church, Va., American Society of Photogrammetry, 1972, p. 367-383. NASA-supported research

MAJS: /*AERIAL PHOTOGRAPHY/*EARTH RESOURCES SURVEY AIRCRAFT /*GROUND TRUTH/*HELICOPTERS/*PHOTOINTERPRETATION

MINS: / AGRICULTURE/ CROP GROWTH/ DATA ACQUISITION/ IMAGERY/ LAND USE/ PHOTOMAPPING/ REMOTE SENSORS/ SNOW COVER

73A18819* ISSUE 6 PAGE 692 CATEGORY 10 CNT#:
NGL-07-002-002 73/00/00 3 PAGES UNCLASSIFIED DOCUMENT

UTTL: Application of pole-placement theory to helicopter stabilization systems.

AUTH: A/SRIDHAR, B.; B/LINDORFF, D. P. PAA: B/(Connecticut, University, Storrs, Conn.)
In: Hawaii International Conference on System Sciences, 6th, Honolulu, Hawaii, January 9-11, 1973, Proceedings. (A73-18801 06-10) North Hollywood, Calif., Western Periodicals Co., 1973, p. 405-407.

MAJS: /*AIRCRAFT STABILITY/*CH-46 HELICOPTER/*COMPLEX SYSTEMS/*FEEDBACK CONTROL/*HELICOPTER CONTROL

MINS: / CONTROL STABILITY/ CONTROL THEORY/ EIGENVALUES/ EQUATIONS OF MOTION/ LEAST SQUARES METHOD/ LINEARIZATION/ NONLINEAR EQUATIONS/ OPTIMAL CONTROL/ STATE VECTORS

ABA: (Author)

ABS: This paper is concerned with the problem of designing a controller for a complex dynamical system using output feedback. The system selected for the study is the Boeing-Vertol CH-46 tandem rotor helicopter. Feedback gains are obtained by a least square solution of the nonlinear equations derived from pole-placement theory.

73A17616*# ISSUE 6 PAGE 647 CATEGORY 2 RPT#:
AIAA PAPER 73-27 73/01/00 14 PAGES UNCLASSIFIED DOCUMENT

UTTL: Research on future short-haul aircraft at the NASA Langley Research Center.

AUTH: A/RIEBE, J. M.; B/KUHN, R. E. PAA: B/(NASA, Langley Research Center, Low-Speed Aircraft Div., Hampton, Va.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00
American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 9th, Washington, D.C., Jan. 8-10, 1973, 14 p.

MAJS: /*AIRCRAFT CONFIGURATIONS/*NASA PROGRAMS/*SHORT HAUL AIRCRAFT/*TRANSPORT AIRCRAFT

MINS: / AIRCRAFT DESIGN/ AIRCRAFT NOISE/ ALL-WEATHER AIR NAVIGATION/ FIXED WINGS/ HELICOPTERS/ NOISE REDUCTION/ ROTARY WING AIRCRAFT/ SHORT TAKEOFF AIRCRAFT

ABA: (Author)

ABS: Some of the current research for improving our short-haul air-transportation system is reviewed. Promising aircraft range from helicopters, turbofan-powered STOL, through mechanical flap reduced take-off and landing (RTOL) concepts. Advanced rotorcraft technology can provide improved passenger, community, operational, and economic acceptability of civil transport helicopters. From wind-tunnel and design studies, techniques are available for achieving low-noise fixed-wing STOL and RTOL through proper engine and airframe design. Agreeable ride qualities, crosswind landing capability, and all-weather terminal operation are also goals of present effort.

73A10046*# ISSUE 1 PAGE 4 CATEGORY 2 CNT#:
NAS2-4151 72/10/00 4 PAGES UNCLASSIFIED DOCUMENT

UTTL: Random gust response statistics for coupled torsion-flapping rotor blade vibrations.

AUTH: A/GAONKAR, G. H.; B/HOHENEMSER, K. H.; C/YIN, S. K. PAA: C/(Washington University, St. Louis, Mo.)
Journal of Aircraft, vol. 9, Oct. 1972, p. 726-729.

MAJS: /*COUPLED MODES/*FLAPPING/*GUST LOADS/*ROTARY WINGS/*ROTOR AERODYNAMICS/*TORSIONAL VIBRATION

MINS: / ATMOSPHERIC TURBULENCE/ DYNAMIC STABILITY/ RANDOM PROCESSES/ STATISTICAL ANALYSIS/ TURBULENCE EFFECTS

ABA: (Author)

ABS: An analysis of coupled torsion-flapping rotor blade vibrations in response to atmospheric turbulence revealed that at high rotor advance ratios anticipated for future high speed pure or convertible rotorcraft both flapping and torsional vibrations can be severe. While appropriate feedback systems can alleviate flapping, they have little effect on torsion. Dynamic stability margins have also no substantial influence on dynamic torsion loads. The only effective means found to alleviate turbulence caused torsional vibrations and loads at high advance ratio was a substantial torsional stiffness margin with respect to local static torsional divergence of the retreating blade.

72A45327*# ISSUE 24 PAGE 3361 CATEGORY 1 CNT#: NAS1-10946 72/00/00 12 PAGES UNCLASSIFIED DOCUMENT

UTTL: Investigation of the stability of the tip vortex generated by hovering propellers and rotors.

AUTH: A/TANGLER, J. L. PAA: A/(Bell Helicopter Co., Fort Worth, Tex.)

In: Atmospheric Flight Mechanics Conference, 2nd, Palo Alto and Moffett Field, Calif., September 11-13, 1972, Informal Papers. (A72-45326 24-01) Moffett Field, Calif., NASA Ames Research Center, 1972, p. 1.1-1.12.

MAJS: /*FLOW STABILITY/*PROPELLER BLADES/*ROTARY WINGS/*ROTOR AERODYNAMICS/*VORTEX GENERATORS/*VORTICES

MINS: / BLADE TIPS/ FLOW VISUALIZATION/ HELICOPTER WAKES/ PROPELLER SLIPSTREAMS/ SCHLIEREN PHOTOGRAPHY/ TIP SPEED/ VORTEX SHEETS

ABA: (Author)

ABS: The objective of this experimental and theoretical investigation was to determine what factors and mechanisms are involved in vortex interaction and instability and how these phenomena manifest themselves. To answer these questions, the schlieren method of flow visualization was used to observe the wakes generated by two- and four-bladed model propellers and rotors. A concurrent free-wake analysis was conducted for comparative purposes. Schlieren pictures showing wake asymmetry, interaction, and instability are presented. Various factors and mechanisms believed to be responsible for these are discussed along with the effects produced by the number of blades, collective pitch, and tip speed. Free-wake calculations that qualitatively confirm these factors responsible for wake asymmetry and interaction are also presented.

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72A38137*# ISSUE 19 PAGE 2752 CATEGORY 2 RPT#: AIAA PAPER 72-778 CNT#: NAS2-5143 72/08/00 9 PAGES UNCLASSIFIED DOCUMENT

UTTL: The inclusion of rotor dynamics in controller design for helicopters.

UNOC: State-feedback-controllers and state-estimators design for roll-pitch-horizontal motions of helicopter near hover, using rotor dynamics model

AUTH: A/HALL, W. E., JR.; B/BRYSON, A. E., JR. PAA: A/(Systems Control, Inc., Palo Alto, Calif.); B/(Stanford University, Stanford, Calif.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00

American Institute of Aeronautics and Astronautics, Aircraft Design, Flight Test, and Operations Meeting, 4th, Los Angeles, Calif., Aug. 7-9, 1972, 9 p.

MAJS: /*CONTROLLERS/*ESTIMATORS/*FEEDBACK CONTROL/*HELICOPTER DESIGN/*ROTOR AERODYNAMICS

MINS: / DYNAMIC MODELS/ EIGENVALUES/ ERROR ANALYSIS/ MATRICES (MATHEMATICS)

ABA: (Author)

ABS: State-feedback-controllers and state-estimators (filters) are designed for the roll-pitch-horizontal motions of a helicopter near hover, using a new quadratic synthesis technique. One model (tenth order) uses a dynamic model of the rotor, whereas the other model (sixth order) assumes the rotor can be tilted instantaneously. It is shown that, for tight control, neglecting the rotor dynamics in designing the autopilot can produce unstable closed-loop response on the model that includes rotor dynamics. Two filters are designed to use only fuselage sensors and two are designed to use both fuselage and rotor sensors. It is shown that rotor states can be estimated with sufficient accuracy using only fuselage sensors so that it does not seem worthwhile to use rotor sensors. The mean square response of the vehicle to a gusty, random wind, using several different filter/state-feedback compensators, is shown to be satisfactory.

72A34502* ISSUE 17 PAGE 2490 CATEGORY 2 RPT#: AHS PREPRINT 642 CNT#: N00019-71-C-0044 72/05/00 13 PAGES UNCLASSIFIED DOCUMENT

UTTL: An experimental investigation of STOL longitudinal flying qualities in the landing approach using the variable stability X-22A aircraft.

AUTH: A/SCHULER, J. M.; B/SMITH, R. E.; C/LEBACQZ, J. V. PAA: C/(Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00

American Helicopter Society, Annual National Forum, 28th, Washington, D.C., May 17-19, 1972, 13 p. FAA-USAF-NASA-sponsored research;

MAJS: /*AIRCRAFT STABILITY/*APPROACH CONTROL/*LONGITUDINAL CONTROL/*SHORT TAKEOFF AIRCRAFT/*X-22 AIRCRAFT

MINS: / AIRCRAFT LANDING/ CONFERENCES/ FLIGHT CONTROL/ HELICOPTER CONTROL/ INSTRUMENT FLIGHT RULES/ TURBULENCE EFFECTS/ VISUAL FLIGHT RULES

ABA: (Author)

ABS: The first in-flight flying qualities experiment using the variable stability X-22A aircraft investigated longitudinal flying qualities requirements for STOL aircraft in terminal area operations. Emphasis was placed on defining minimum requirements for the short-term response in VFR and IFR landing approaches at representative steep STOL approach conditions of 65 and 80 knots. Evaluation flights were conducted in negligible and moderate turbulence for a wide range of short-term frequencies and dampings. The results were compared with the short-term requirements of MIL-F-83300. The specified Level 1 and 2 VFR

boundaries were found to be approximately valid in moderate turbulence for both VFR and IFR flight conditions. In negligible turbulence, the specified VFR Level 2 boundary was also approximately valid but the Level 1 boundary was found to be too stringent. Pilot rating gradients with damping were more apparent than with frequency for the range investigated.

72A25413*# ISSUE 11 PAGE 1574 CATEGORY 2 RPT#: AIAA PAPER 72-392 CNT#: NAS1-10459 72/04/00 7 PAGES UNCLASSIFIED DOCUMENT

UTTL: Design, analysis, and test of a boron/epoxy reinforced airframe.

UNOC: Fatigue strength characteristics of boron-epoxy reinforced Al stringers for helicopter airframe

AUTH: A/RICH, M. J.; B/WELGE, R. T. PAA: B/(United Aircraft Corp., Sikorsky Aircraft Div., Stratford, Conn.) SAP: MEMBERS, $1.50; NONMEMBERS, $2.00 AIAA, ASME, and SAE, Structures, Structural Dynamics, and Materials Conference, 13th, San Antonio, Tex., Apr. 10-12, 1972, 7 p.

MAJS: /*AIRFRAME MATERIALS/*ALUMINUM/*BORON/*EPOXY RESINS/*FATIGUE LIFE/*HELICOPTER DESIGN

MINS: / CONFERENCES/ FAILURE MODES/ MECHANICAL PROPERTIES/ REINFORCED PLASTICS/ REINFORCEMENT (STRUCTURES)/ SHEAR STRESS/ STRINGERS/ TENSILE TESTS

ABA: (Author)

ABS: The airframe of a large helicopter generally requires additional stiffening for dynamic tuning to prevent resonance with the rotor vibratory forces. Investigations showed that aluminum stringers reinforced with boron/epoxy offered substantial weight saving for the CH54B Skycrane helicopter to achieve the required airframe stiffness. As a result, a program has been conducted under a NASA contract to design, test, and evaluate the static and fatigue strength characteristics of the composite reinforcement. The results of this phase of the effort will be reported in this paper.

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72A15774*# ISSUE 5 PAGE 611 CATEGORY 2 72/01/00 5 PAGES UNCLASSIFIED DOCUMENT

UTTL: The new civil aviation within our grasp.

UNOC: Civil aircraft technological constraints and requirements, discussing noise, congestion and performance characteristics of rotorcraft, STOL, VTOL, hypersonic and supersonic transports

AUTH: A/CORTRIGHT, E. M. PAA: A/(NASA, Langley Research Center, Hampton, Va.) Astronautics and Aeronautics, vol. 10, Jan. 1972, p. 30-34.

MAJS: /*AIRCRAFT NOISE/*AIRCRAFT PERFORMANCE/*CIVIL AVIATION /*TECHNOLOGY ASSESSMENT/*TRANSPORT AIRCRAFT

MINS: / HYPERSONIC AIRCRAFT/ ROTARY WING AIRCRAFT/ SHORT TAKEOFF AIRCRAFT/ SUPERSONIC TRANSPORTS/ VERTICAL TAKEOFF AIRCRAFT

ABA: G.R.

ABS: Noise and congestion present the two main technological constraints on air-transportation growth. Although some of the noise reduction will come with improved flight-path control and steep approaches, the main requirement remains quiet propulsion systems. Higher engine temperatures will compensate for efficiency losses due to noise suppression. Composite structures can reduce structural weight by 20%. New developments in rotorcraft transports are discussed together with advanced subsonic transports of the 1980s and the possibilities for further evolution of the SSTs, leading to a hypersonic aircraft.

71A41500*# ISSUE 22 CATEGORY 1 RPT#: AIAA PAPER 71-581 CNT#: DAAJ02-0070-C-0009 DAAJ02-0069-C-0056 DAAJ02-0069-C-0039 NAS1-8350 71/06/00 16 PAGES UNCLASSIFIED DOCUMENT

UTTL: Wake and boundary layer effects in helicopter rotor aerodynamics

UNOC: Helicopter wake and boundary layer effects on rotor aerodynamic performance in hovering, low and high speed forward flight

AUTH: A/CLARK, D. R.; B/LANDGREBE, A. J. PAN: (AA/UNITED AIRCRAFT CORP., SIKORSKY DIV., STRATFORD, CONN./ AB/UNITED AIRCRAFT RESEARCH LABS., EAST HARTFORD, CONN./.) SAP: MEMBERS, DOL. 1.50, NONMEMBERS, DOL. 2.00. NEW YORK, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, FLUID AND PLASMA DYNAMICS CONFERENCE, 4TH, PALO ALTO, CALIF., JUN. 21-23, 1971.

MAJS: /*BOUNDARY LAYERS/*HELICOPTER PERFORMANCE/*HELICOPTER WAKES/*LIFTING ROTORS/*ROTOR AERODYNAMICS

MINS: / CONFERENCES/ CORIOLIS EFFECT/ FLIGHT CHARACTERISTICS / HORIZONTAL FLIGHT/ HOVERING/ ROTOR BLADES/ VISCOSITY / VORTEX SHEETS/ VORTICITY

71A31089*# ISSUE 14 PAGE 2172 CATEGORY 1 RPT#: AHS PREPRINT 523 CNT#: NAS1-6448 71/05/00 11 PAGES UNCLASSIFIED DOCUMENT

UTTL: A method for predicting helicopter wake geometry, wake-induced flow and wake effects on blade airloads

UNOC: Wake model and computer program to compute geometries, flows and velocity influence coefficients for helicopter blade load calculations

AUTH: A/SADLER, S. G. PAN: (AA/ROCHESTER APPLIED SCIENCE

ASSOCIATES, INC., ROCHESTER, N.Y./.) AVAIL.NTIS SAP: MEMBERS, DOL. 1.25, NONMEMBERS, DOL. 2.00. NEW YORK, AMERICAN HELICOPTER SOCIETY, INC., AMERICAN HELICOPTER SOCIETY, ANNUAL NATIONAL V/STOL FORUM, 27TH, WASHINGTON, D.C., MAY 19-21, 1971.
MAJS: /*AERODYNAMIC LOADS/*HELICOPTER WAKES/*INFLUENCE COEFFICIENT/*MATHEMATICAL MODELS/*ROTARY WINGS
MINS: / COMPUTER PROGRAMS/ CONFERENCES/ FLOW GEOMETRY/ FLOW VELOCITY/ FREE FLOW/ VORTICES

71A31083*# ISSUE 14 PAGE 2178 CATEGORY 2 RPT#: AHS PREPRINT 512 CNT#: NAS2-4151 71/05/00 14 PAGES UNCLASSIFIED DOCUMENT
UTTL: The method of multiblade coordinates in the linear analysis of lifting rotor dynamic stability and gust response at high advance ratio
UNOC: High rotor advance ratio from multiblade general coordinates method in linear analysis of lifting rotor dynamic stability and gust ratio
AUTH: A/HOHENEMSER, K. H.; B/YIN, S.-K. PAN: (AA/WASHINGTON U., ST. LOUIS, MO./.) AVAIL.NTIS SAP: MEMBERS, DOL. 1.25, NONMEMBERS, DOL. 2.00. NEW YORK, AMERICAN HELICOPTER SOCIETY, INC., AMERICAN HELICOPTER SOCIETY, ANNUAL NATIONAL V/STOL FORUM, 27TH, WASHINGTON, D.C., MAY 19-21, 1971.
MAJS: /*DYNAMIC STABILITY/*GUSTS/*HELICOPTER DESIGN/*LIFTING ROTORS/*SYSTEMS ANALYSIS
MINS: / ATMOSPHERIC TURBULENCE/ CONFERENCES/ DIFFERENTIAL EQUATIONS/ FEEDBACK CONTROL/ ROTOR BLADES/ WIND EFFECTS

71A31081* ISSUE 14 PAGE 2171 CATEGORY 1 RPT#: AHS PREPRINT 510 CNT#: NGR-22-009-303 N00019-69-C-0219 71/05/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Application of a lifting-surface theory to the calculation of helicopter airloads
UNOC: Helicopter rotor blade airload by applying lifting surface solution
AUTH: A/JOHNSON, W. PAN: (AA/MIT, CAMBRIDGE, MASS./.) AVAIL.NTIS SAP: MEMBERS, DOL. 1.25, NONMEMBERS, DOL. 2.00. NEW YORK, AMERICAN HELICOPTER SOCIETY, INC., AMERICAN HELICOPTER SOCIETY, ANNUAL NATIONAL V/STOL FORUM, 27TH, WASHINGTON, D.C., MAY 19-21, 1971.
MAJS: /*AERODYNAMIC LOADS/*HELICOPTERS/*LIFTING ROTORS/*ROTARY WINGS/*WING LOADING
MINS: / CONFERENCES/ FLOW GEOMETRY/ HELICOPTER WAKES/ LIFTING BODIES/ MATHEMATICAL MODELS/ VORTICES

71A31078* ISSUE 14 PAGE 2178 CATEGORY 2 RPT#: AHS PREPRINT 502 CNT#: NAS2-5168 71/05/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: Horizontal stoppable rotor conversion
UNOC: Stiffened horizontal stoppable hingeless rotor conversion from helicopter to airplane flight speeds
AUTH: A/BIGGERS, J. C.; B/WATTS, G. A. PAN: (AB/LOCKHEED-CALIFORNIA CO., BURBANK, CALIF./ AA/NASA, AMES RESEARCH CENTER, MOFFETT FIELD, CALIF./.) AVAIL.NTIS SAP: MEMBERS, DOL. 1.25, NONMEMBERS, DOL. 2.00. NEW YORK, AMERICAN HELICOPTER SOCIETY, INC., ARMY-SUPPORTED RESEARCH. AMERICAN HELICOPTER SOCIETY, ANNUAL NATIONAL V/STOL FORUM, 27TH, WASHINGTON, D.C., MAY 19-21, 1971.
MAJS: /*RIGID ROTORS/*ROTARY WINGS
MINS: / AEROELASTICITY/ AIRSPEED/ CONFERENCES/ CONTROL STABILITY/ FEATHERING/ GYROSCOPES/ HELICOPTER PERFORMANCE/ HUBS/ WIND TUNNELS

71A18423* ISSUE 6 PAGE 880 CATEGORY 11 71/01/00 6 PAGES UNCLASSIFIED DOCUMENT
UTTL: An evaluation of low-visibility landing systems by simulation
UNOC: Helicopter automatic and manual low visibility landing systems evaluation by hybrid computer simulation
AUTH: A/KOZIOL, J. S., JR.; B/REMPFER, P. S.; C/STEVENSON, L. E. PAN: (AA/NASA, ELECTRONICS RESEARCH CENTER, CAMBRIDGE, MASS./.) VERTIFLITE, VOL. 17, P. 4-7, 10, 11.
MAJS: /*AIRCRAFT LANDING/*AUTOMATIC LANDING CONTROL/*HELICOPTERS/*LANDING SIMULATION/*LOW VISIBILITY/*MANUAL CONTROL
MINS: / ATTITUDE (INCLINATION)/ COMPUTERIZED SIMULATION/ GLIDE PATHS/ HYBRID COMPUTERS/ INSTRUMENT FLIGHT RULES

71A17158*# ISSUE 5 PAGE 695 CATEGORY 1 70/00/00 43 PAGES UNCLASSIFIED DOCUMENT
UTTL: A review of rotating blade noise technology
UNOC: Rotating blade noise technology, discussing vehicles and components, noise nature, generation, reduction and prediction
AUTH: A/HUBBARD, H. H.; B/LANSING, D. L.; C/RUNYAN, H. L. PAN: (AC/NASA, LANGLEY RESEARCH CENTER, DYNAMIC LOADS DIV., HAMPTON, VA./.) LOUGHBOROUGH, ENGLAND, LOUGHBOROUGH U. OF TECHNOLOGY. IN- LOUGHBOROUGH U. OF TECHNOLOGY. SYMPOSIUM ON AERODYNAMIC NOISE, LOUGHBOROUGH, LEICS., ENGLAND, SEP. 14-17, 1970. PREPRINTS, P. D.1.1-D.1.43. /A71-17152 05-23/
MAJS: /*AERODYNAMIC NOISE/*NOISE REDUCTION/*ROTOR BLADES

MINS: / CONFERENCES/ HELICOPTERS/ NOISE SPECTRA/ ROTARY WINGS/ TECHNOLOGIES

71A15421*# ISSUE 4 PAGE 532 CATEGORY 2
70/00/00 6 PAGES UNCLASSIFIED DOCUMENT
UTTL: Measurements and analysis of vibration ride environments
UNOC: Air transportation systems ride vibration environments in relation to human comfort
AUTH: A/CATHERINES, J. J.; B/CLEVENSON, S. A. PAN: (AB/NASA, LANGLEY RESEARCH CENTER, HAMPTON, VA./.)
NEW YORK, AMERICAN HELICOPTER SOCIETY, INC., IN-AMERICAN HELICOPTER SOCIETY, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, AND U. OF TEXAS, JOINT SYMPOSIUM ON ENVIRONMENTAL EFFECTS ON VTOL DESIGNS, ARLINGTON, TEX., NOV. 16-18, 1970, PROCEEDINGS. /A71-15401 04-02/
MAJS: /*AIR TRANSPORTATION/*COMFORT/*FLIGHT CHARACTERISTICS /*HUMAN TOLERANCES/*VIBRATION MEASUREMENT
MINS: / CONFERENCES/ HELICOPTERS/ SHORT TAKEOFF AIRCRAFT

71A15406*# ISSUE 4 PAGE 531 CATEGORY 2
70/00/00 13 PAGES UNCLASSIFIED DOCUMENT
UTTL: The effect of various operating parameters on the noise radiation patterns from a helicopter in forward flight
UNOC: Helicopter in-flight noise radiation pattern and spectra measurements for various operating parameters
AUTH: A/PEGG, R. J. PAN: (AA/NASA LANGLEY RESEARCH CENTER, HAMPTON, VA./.)
NEW YORK, AMERICAN HELICOPTER SOCIETY, INC., IN-AMERICAN HELICOPTER SOCIETY, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, AND U. OF TEXAS, JOINT SYMPOSIUM ON ENVIRONMENTAL EFFECTS ON VTOL DESIGNS, ARLINGTON, TEX., NOV. 16-18, 1970, PROCEEDINGS. /A71-15401 04-02/
MAJS: /*ACOUSTIC MEASUREMENT/*AIRCRAFT NOISE/*FLIGHT TESTS/* HELICOPTERS/*NOISE SPECTRA/*RADIATION DISTRIBUTION
MINS: / AIRSPEED/ CONFERENCES/ NOISE REDUCTION/ ROTOR SPEED/ THRUST

71A15171* ISSUE 4 PAGE 529 CATEGORY 2 70/12/00
4 PAGES UNCLASSIFIED DOCUMENT
UTTL: History of NACA/NASA rotating-wing aircraft research, 1915-1970. IV Cont'd
UNOC: NACA/NASA rotary wing aircraft research, considering rotor loads and configurations, ground resonance, blade flutter and flapping, motion equations and VTOL
AUTH: A/GUSTAFSON, F. B. PAN: (AA/NASA, LANGLEY RESEARCH CENTER, HAMPTON, VA./.)
VERTIFLITE, VOL. 16, P. 9-11, 30.

MAJS: /*HELICOPTER DESIGN/*NASA PROGRAMS/*RESEARCH PROJECTS /*ROTARY WING AIRCRAFT
MINS: / EQUATIONS OF MOTION/ FLAPPING/ FLUTTER/ GROUND EFFECT/ RESONANCE/ ROTOR BLADES/ TILTING ROTORS/ VERTICAL TAKEOFF AIRCRAFT

71A11377* ISSUE 1 PAGE 5 CATEGORY 2 70/11/00
4 PAGES UNCLASSIFIED DOCUMENT
UTTL: History of NACA/NASA rotating-wing aircraft research, 1915-1970. IV
UNOC: NACA/NASA rotating wing aircraft research history during 1955-1970 period, discussing wind tunnel research
AUTH: A/GUSTAFSON, F. B. PAN: (AA/NASA, LANGLEY RESEARCH CENTER, HAMPTON, VA./.)
VERTIFLITE, VOL. 16, P. 6-9.
MAJS: /*HELICOPTER DESIGN/*HISTORIES/*NASA PROGRAMS/* RESEARCH AND DEVELOPMENT/*ROTARY WING AIRCRAFT
MINS: / ROTOR AERODYNAMICS/ VERTICAL TAKEOFF AIRCRAFT/ WIND TUNNEL STABILITY TESTS

70A45918*# ISSUE 24 PAGE 4291 CATEGORY 2 RPT#: AIAA PAPER 70-1262 70/10/00 18 PAGES UNCLASSIFIED DOCUMENT
UTTL: Aeronautical vehicles - 1970 and beyond
UNOC: Air transportation beyond 1970, discussing general aviation, short haul systems, STOL, helicopter, V/STOL, subsonic, supersonic and hypersonic aircraft
AUTH: A/LOFTIN, L. K., JR. PAN: (LOFTIN, L. K., JR/NASA, LANGLEY RESEARCH CENTER, HAMPTON, VA./.) SAP: MEMBERS, $1.50, NONMEMBERS, $2.00.
NEW YORK, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, ANNUAL MEETING AND TECHNICAL DISPLAY, 7TH, HOUSTON, TEX., OCT. 19-22, 1970.
MAJS: /*AIR TRANSPORTATION/*TRANSPORT AIRCRAFT
MINS: / CONFERENCES/ GENERAL AVIATION AIRCRAFT/ HELICOPTERS/ HYPERSONIC AIRCRAFT/ SHORT HAUL AIRCRAFT/ SUPERSONIC AIRCRAFT/ V/STOL AIRCRAFT

70A44856* ISSUE 23 PAGE 4[illegible] CATEGORY 2
70/10/00 6 PAGES UNCLASSIFIED DOCUMENT
UTTL: History of NACA/NASA rotating-wing aircraft research, 1915-1970. III Cont'd
UNOC: NACA/NASA rotating wing aircraft research history 1915-1970. Part 3, covering rotor dynamics and flying qualities, hovering tests, rotor flow, loads, etc
AUTH: A/GUSTAFSON, F. B. PAN: (AA/NASA, LANGLEY RESEARCH CENTER, FLIGHT MECHANICS AND TECHNOLOGY DIV., HAMPTON, VA./.)
VERTIFLITE, VOL. 16, P. 14-18, 24.

MAJS: /*NASA PROGRAMS/*RESEARCH PROJECTS/*ROTARY WING AIRCRAFT/*ROTOR AERODYNAMICS
MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMIC LOADS/ DYNAMIC MODELS/ FLOW CHARACTERISTICS/ HOVERING STABILITY/ ROTARY WINGS/ STRESS ANALYSIS/ TEST FACILITIES

70A44853* ISSUE 23 PAGE 4142 CATEGORY 2
70/09/00 4 PAGES UNCLASSIFIED DOCUMENT
UTTL: History of NACA/NASA rotating-wing aircraft research, 1915-1970. III
UNOC: NACA/NASA rotary wing aircraft research history 1915-1970. Part 3, covering rotor and helicopter theory, related flight and wind tunnel testing, etc
AUTH: A/GUSTAFSON, F. B. PAN: (AA/NASA, LANGLEY RESEARCH CENTER, FLIGHT MECHANICS AND TECHNOLOGY DIV., HAMPTON, VA./.)
VERTIFLITE, VOL. 16, P. 10, 11, 14, 15.
MAJS: /*FLIGHT TESTS/*NASA PROGRAMS/*RESEARCH PROJECTS/*ROTARY WING AIRCRAFT/*WIND TUNNELS
MINS: / AERODYNAMIC CHARACTERISTICS/ AERODYNAMICS/ AIRCRAFT STABILITY/ AUTOROTATION/ FLIGHT CHARACTERISTICS/ GROUND EFFECT/ HELICOPTER CONTROL/ HELICOPTERS/ HISTORIES/ ROTOR AERODYNAMICS

70A44852* ISSUE 23 PAGE 4142 CATEGORY 2
70/07/00 4 PAGES UNCLASSIFIED DOCUMENT
UTTL: History of NACA/NASA rotating-wing aircraft research, 1915-1970. II
UNOC: NACA/NASA rotating wing aircraft research history 1915-1970. Part 2, autogyro flight test experiences, rotor blade dynamics research, interest in helicopters, etc
AUTH: A/GUSTAFSON, F. B. PAN: (AA/NASA, LANGLEY RESEARCH CENTER, FLIGHT MECHANICS AND TECHNOLOGY DIV., HAMPTON, VA./.)
VERTIFLITE, VOL. 16, P. 10, 11, 14, 15.
MAJS: /*DYNAMIC CHARACTERISTICS/*NASA PROGRAMS/*RESEARCH PROJECTS/*ROTARY WING AIRCRAFT/*ROTOR BLADES
MINS: / AUTOGYROS/ FLIGHT TESTS/ GROUND TESTS/ HELICOPTER DESIGN/ HISTORIES/ PRODUCT DEVELOPMENT

70A44851* ISSUE 23 PAGE 4142 CATEGORY 2
70/06/00 8 PAGES UNCLASSIFIED DOCUMENT
UTTL: History of NACA/NASA rotating-wing aircraft research, 1915-1970. I
UNOC: NACA/NASA rotary wing aircraft research covering autogyro and helicopter development, noting flight safety
AUTH: A/GUSTAFSON, F. B. PAN: (AA/NASA, LANGLEY RESEARCH CENTER, FLIGHT MECHANICS AND TECHNOLOGY DIV., HAMPTON, VA./.)
VERTIFLITE, VOL. 16, P. 4-11.
MAJS: /*AUTOGYROS/*HELICOPTER DESIGN/*NASA PROGRAMS
MINS: / CONFERENCES/ FLIGHT SAFETY/ ROTARY WINGS/ WIND TUNNELS

70A44323* ISSUE 23 PAGE 4130 CATEGORY 2
70/10/00 8 PAGES UNCLASSIFIED DOCUMENT
UTTL: A note on a phenomenon affecting helicopter directional control in rearward flight
UNOC: Main rotor wake adverse effects on tail rotor directional control in low velocity wind
AUTH: A/HUSTON, R. J.; B/MORRIS, C. E., JR. PAN: (AB/NASA, LANGLEY RESEARCH CENTER, HAMPTON, VA./.)
AMERICAN HELICOPTER SOCIETY, JOURNAL, VOL. 15, P. 38-45.
MAJS: /*DIRECTIONAL CONTROL/*HELICOPTER CONTROL/*HELICOPTER WAKES/*ROTARY WINGS/*TAIL ASSEMBLIES
MINS: / AIRSPEED/ CONFERENCES/ FREE FLOW/ TORQUE/ VORTICES/ WIND VELOCITY

70A39582*# ISSUE 20 PAGE 3558 CATEGORY 1 RPT#: AIAA PAPER 70-945 70/08/00 9 PAGES UNCLASSIFIED DOCUMENT
UTTL: Dynamic stall simulation problems
UNOC: Dynamic airfoil stall simulation in wind tunnels, considering pitch rate, Reynolds number, oscillation and test equipment effects
AUTH: A/ERICSSON, L. E.; B/REDING, J. P. PAN: (AB/LOCKHEED MISSILES AND SPACE CO., SUNNYVALE, CALIF./.) SAP: MEMBERS, $1.25, NONMEMBERS, $2.00.
NEW YORK, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, GUIDANCE, CONTROL AND FLIGHT MECHANICS CONFERENCE, SANTA BARBARA, CALIF., AUG. 17-19, 1970.
MAJS: /*AERODYNAMIC STALLING/*AIRFOILS/*DYNAMIC MODELS/*WIND TUNNEL MODELS
MINS: / AERODYNAMIC COEFFICIENTS/ COMPRESSORS/ FLUTTER/ HELICOPTERS/ LAMINAR FLOW/ LEADING EDGES/ PITCHING MOMENTS/ REYNOLDS NUMBER/ SPACE SHUTTLES/ TRAILING EDGES/ TURBULENCE EFFECTS

70A34739* ISSUE 17 PAGE 3016 CATEGORY 2
70/06/00 14 PAGES UNCLASSIFIED DOCUMENT
UTTL: Helicopter rotor periodic differential pressures and structural response measured in transient and steady-state maneuvers
UNOC: Helicopter rotor blade differential pressure and structural load characteristics in transient and steady state maneuvers
AUTH: A/WARD, J. F. PAN: (AA/NASA, LANGLEY

RESEARCH CENTER, FLIGHT MECHANICS AND TECHNOLOGY DIV., HAMPTON, VA./.) SAP: MEMBERS, $1.25, NONMEMBERS, $2.00.
NEW YORK, AMERICAN HELICOPTER SOCIETY, AMERICAN HELICOPTER SOCIETY, ANNUAL NATIONAL FORUM, 26TH, WASHINGTON, D.C., JUN. 16-18, 1970.
MAJS: /*AERODYNAMIC LOADS/*HELICOPTER PERFORMANCE/*MANEUVERS /*ROTARY WINGS
MINS: / CONFERENCES/ FLIGHT RECORDERS/ STRUCTURAL STRAIN/ TRANSIENT RESPONSE

70A34737* ISSUE 17 PAGE 3009 CATEGORY 1 CNT#: NGR-39-009-111 70/06/00 12 PAGES UNCLASSIFIED DOCUMENT
UTTL: A study of rotor blade-vortex interaction
UNOC: Surface pressure and lift measurement on model lifting rotor blade as function of vortex interaction, using flush mounted pressure transducers
AUTH: A/MCCORMICK, B. W., JR.; B/SURENDRAIAH, M. PAN: (AA/PENNSYLVANIA STATE U., UNIVERSITY PARK, PA./.) SAP: MEMBERS, $1.25, NONMEMBERS, $2.00.
NEW YORK, AMERICAN HELICOPTER SOCIETY, AMERICAN HELICOPTER SOCIETY, ANNUAL NATIONAL FORUM, 26TH, WASHINGTON, D.C., JUN. 16-18, 1970.
MAJS: /*LIFTING ROTORS/*PRESSURE MEASUREMENT/*VORTEX GENERATORS
MINS: / CONFERENCES/ HELICOPTER DESIGN/ PRESSURE SENSORS/ ROTARY WINGS

70A34730* ISSUE 17 PAGE 3199 CATEGORY 34 CNT#: NSR-05-020-151 70/06/00 10 PAGES UNCLASSIFIED DOCUMENT
UTTL: Metropolitan air transit system
UNOC: Computerized metropolitan air transit system, discussing system redundancy for safety level maintainance and all-weather dependability
AUTH: A/ANDREGLI, A. E. PAN: (AA/STANFORD U., STANFORD, CALIF./.) SAP: MEMBERS, $1.25, NONMEMBERS, $2.00.
NEW YORK, AMERICAN HELICOPTER SOCIETY, AMERICAN HELICOPTER SOCIETY, ANNUAL NATIONAL FORUM, 26TH, WASHINGTON, D.C., JUN. 16-18, 1970.
MAJS: /*AIR TRANSPORTATION/*REDUNDANT COMPONENTS/*SYSTEMS ENGINEERING/*URBAN TRANSPORTATION
MINS: / ALL-WEATHER AIR NAVIGATION/ COMPUTER PROGRAMS/ CONFERENCES/ COST ANALYSIS/ HELICOPTER DESIGN/ RAPID TRANSIT SYSTEMS

70A34704* ISSUE 17 PAGE 3013 CATEGORY 2 CNT#: NAS1-7880 70/06/00 13 PAGES UNCLASSIFIED DOCUMENT
UTTL: Simplified procedures for estimating flapwise bending moments on helicopter rotor blades
UNOC: Helicopter rotor blades flapwise bending moments prediction by transfer function/superposition techniques
AUTH: A/LANDGREBE, A. J. PAN: (AA/UNITED AIRCRAFT RESEARCH LABS., EAST HARTFORD, CONN./.) SAP: MEMBERS, $1.25, NONMEMBERS, $2.00.
NEW YORK, AMERICAN HELICOPTER SOCIETY, AMERICAN HELICOPTER SOCIETY, ANNUAL NATIONAL FORUM, 26TH, WASHINGTON, D.C., JUN. 16-18, 1970.
MAJS: /*BENDING MOMENTS/*PERFORMANCE PREDICTION/*ROTARY WINGS/*ROTOR AERODYNAMICS
MINS: / CONFERENCES/ DEGREES OF FREEDOM/ FLAPPING/ HELICOPTER DESIGN/ SUPERPOSITION (MATHEMATICS)/ TRANSFER FUNCTIONS

70A33318* ISSUE 15 PAGE 2884 CATEGORY 10 70/00/00 9 PAGES UNCLASSIFIED DOCUMENT
UTTL: A frequency domain approach to handling qualities design
UNOC: Linear multivariable feedback control systems design method based on transfer matrix, testing decoupling desirability
AUTH: A/SHIRLEY, R. S.; B/WOLOVICH, W. A. PAN: (AA/NASA, ELECTRONICS RESEARCH CENTER, OFFICE OF CONTROL THEORY AND APPLICATION, CAMBRIDGE, MASS./.)
NEW YORK, AMERICAN SOCIETY OF MECHANICAL ENGINEERS, IN- AMERICAN AUTOMATIC CONTROL COUNCIL, JOINT AUTOMATIC CONTROL CONFERENCE, 11TH, GEORGIA INST. OF TECH., ATLANTA, GA., JUN. 22-26, 1970. PREPRINTS OF TECHNICAL PAPERS, P. 297-305. /A70-33301 16-10/
MAJS: /*FEEDBACK CONTROL/*LINEAR SYSTEMS/*MATRICES (MATHEMATICS)/*SYSTEMS ENGINEERING/*TRANSFER FUNCTIONS
MINS: / CONFERENCES/ CONTROL STABILITY/ DECOUPLING/ FREQUENCY RESPONSE/ HELICOPTER DESIGN/ MATHEMATICAL MODELS

70A29622* ISSUE 13 PAGE 2459 CATEGORY 21 70/05/00 9 PAGES UNCLASSIFIED DOCUMENT
/FOR ABSTRACT SEE ISSUE 01, PAGE 136 ACCESSION NO. A70-10303/
UTTL: Flight test experiments to evaluate aided- inertial system performance for terminal guidance
UNOC: Flight test experiments for H-19 helicopter to evaluate aided inertial system performance for terminal guidance
AUTH: A/MADIGAN, R. J. PAN: (AA/NASA, ELECTRONICS RESEARCH CENTER, CAMBRIDGE, MASS./.)
NAVIGATION, VOL. 17, P. 83-91. /INST. OF NAVIGATION.

ANNUAL MEETING. 25TH, NEW YORK. N.Y.. JUN. 24-26. 1969. PAPER./

MAJS: /*FLIGHT TESTS/*HELICOPTER PERFORMANCE/*INERTIAL NAVIGATION/*PERFORMANCE TESTS/*TERMINAL GUIDANCE

MINS: / AIRCRAFT GUIDANCE/ CONFERENCES/ DATA TRANSMISSION/ DIGITAL SYSTEMS/ FLIGHT SIMULATION/ RADAR NAVIGATION/ SYSTEMS ENGINEERING

PRINT 15/2/1-21 TERMINAL=20

82N23208*# ISSUE 14 PAGE 1698 CATEGORY 3 RPT#: NASA-CP-2219 A-8891 NAS 1.55:2219 82/04/00 243 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter Handling Qualities

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A11/MF A01

Proceedings of the special meeting held at Moffett Field, Calif., 14-15 Apr. 1982; sponsored by the American Helicopter Society

MAJS: /*AIRCRAFT SPECIFICATIONS/*AVIONICS/*COCKPITS/*CONFERENCES/*CONTROLLABILITY/*HELICOPTER CONTROL/*MANEUVERABILITY/*NAP-OF-THE-EARTH NAVIGATION/*NIGHT FLIGHTS (AIRCRAFT)

MINS: / AIRCRAFT INSTRUMENTS/ AIRCRAFT MANEUVERS/ AIRCRAFT RELIABILITY/ AIRCRAFT SURVIVABILITY/ ALL-WEATHER AIR NAVIGATION/ AUTOMATIC FLIGHT CONTROL/ COMBAT/ CONTROL BOARDS/ DISPLAY DEVICES/ FLIGHT CONTROL/ HELICOPTER PERFORMANCE/ RADAR NAVIGATION/ STABILITY AUGMENTATION

ANN: Helicopters are used by the military and civilian communities for a variety of tasks and must be capable of operating in poor weather conditions and at night. Accompanying extended helicopter operations is a significant increase in pilot workload and a need for better handling qualities. An overview of the status and problems in the development and specification of helicopter handling-qualities criteria is presented. Topics for future research efforts by government and industry are highlighted. For individual titles, see N82-23209 through N82-23230.

81N26632*# ISSUE 17 PAGE 2283 CATEGORY 1 RPT#: NASA-CR-164517 CNT#: NASW-3455 NASW-2342 81/00/00 7 VOLS 39 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA's Role in Aeronautics: A Workshop. Volume 5: Rotorcraft

CORP: National Academy of Sciences - National Research Council, Washington, D. C. CSS: (Assembly of Engineering.) AVAIL.NTIS SAP: HC A03/MF A01

Workshop held at Woods Hole, Mass., 27 Jul. - 2 Aug. 1980

MAJS: /*AERONAUTICAL ENGINEERING/*CONFERENCES/*NASA PROGRAMS/*RESEARCH MANAGEMENT/*ROTARY WING AIRCRAFT

MINS: / AEROACOUSTICS/ DEICING/ EMERGENCIES/ FLIGHT CONTROL/ ROTOR AERODYNAMICS

ABA: A.R.H.

ABS: The potential roles for NASA relating to rotorcraft are reviewed. The agency's participation is delineated for each role, a rationale is provided, the current level of activity is summarized, and suggestions are given for the kinds of research still needed. In examining opportunities for the most beneficial deployment of its resources, NASA should consider societal benefits as well as the military and civil markets in formulating the role it can play to support the development of a stronger rotorcraft technology base.

B2N19173*# ISSUE 10 PAGE 1318 CATEGORY 2 RPT#: NASA-TM-84146 80/12/05 149 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshops. Volume 4: Flight Control Avionics Systems and Human Factors

CORP: National Aeronautics and Space Administration. Washington, D. C. AVAIL.NTIS SAP: HC A07/MF A01

Workshop held at Palo Alto, Calif., 2-5 Dec. 1980

MAJS: /*HELICOPTER DESIGN/*HELICOPTER ENGINES/*HELICOPTER PERFORMANCE/*HELICOPTERS/*SHORT TAKEOFF AIRCRAFT/*TECHNOLOGY ASSESSMENT/*USER REQUIREMENTS

MINS: / CONFERENCES/ PAPERS/ PROCEEDINGS/ RESEARCH/ ROTARY WING AIRCRAFT/ TILTING ROTORS

ABA: L.F.M.

ABS: Helicopter user needs, technology requirements and status, and proposed research and development action are summarized. It is divided into three sections: flight dynamics and control; all weather operations; and human factors.

B2N19171*# ISSUE 10 PAGE 1317 CATEGORY 2 RPT#: NASA-TM-84148 80/12/05 111 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshops. Volume 2: Operators' Views

CORP: National Aeronautics and Space Administration. Washington, D. C. AVAIL.NTIS SAP: HC A06/MF A01

Workshop held at Palo Alto, Calif., 2-5 Dec 1980

MAJS: /*HELICOPTER DESIGN/*HELICOPTER ENGINES/*HELICOPTER PERFORMANCE/*HELICOPTERS/*SHORT TAKEOFF AIRCRAFT/*TECHNOLOGY ASSESSMENT/*USER REQUIREMENTS

MINS: / CONFERENCES/ PAPERS/ PROCEEDINGS/ RESEARCH/ ROTARY WING AIRCRAFT/ TILTING ROTORS

ABA: L.F.M.

ABS: A special panel of helicopter users give presentations in 12 basic areas of helicopter applications. Development of the helicopter and the needs for future growth are discussed.

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82N19170*# ISSUE 10 PAGE 1317 CATEGORY 2 RPT#: NASA-TM-84149 80/12/05 115 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshops. Volume 1: Executive Summary

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A06/MF A01
Workshop held at Palo Alto, Calif., 3-5 Dec. 1980

MAJS: /*HELICOPTER DESIGN/*HELICOPTER ENGINES/*HELICOPTER PERFORMANCE/*HELICOPTERS/*SHORT TAKEOFF AIRCRAFT/*TECHNOLOGY ASSESSMENT/*USER REQUIREMENTS

MINS: / CONFERENCES/ PAPERS/ PROCEEDINGS/ RESEARCH/ ROTARY WING AIRCRAFT/ TILTING ROTORS

ABA: L.F.M.

ABS: This presentation provides an overview of the NASA Rotorcraft Program as an introduction to the technical sessions of the Advanced Rotorcraft Technology Workshop. It deals with the basis for NASA's increasing emphasis on rotorcraft technology, NASA's research capabilities, recent program planning efforts, highlights of its 10-year plan and future directions and opportunities.

82N19172*# ISSUE 10 PAGE 1317 CATEGORY 2 RPT#: NASA-TM-84147 80/12/04 285 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshops. Volume 3: Aerodynamics and Structures Session

CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A13/MF A01
Workshop held at Palo Alto, Calif., 2-5 Dec. 1980

MAJS: /*AERODYNAMIC CHARACTERISTICS/*CONFERENCES/*HELICOPTERS/*ROTOR AERODYNAMICS/*ROTOR SYSTEMS RESEARCH AIRCRAFT/*TILT ROTOR AIRCRAFT

MINS: / AERODYNAMIC LOADS/ AERODYNAMICS/ COMPOSITE STRUCTURES/ COMPUTATIONAL FLUID DYNAMICS/ FUSELAGES/ ROTARY WINGS/ STRUCTURAL VIBRATION/ VORTEX ALLEVIATION / WING TIP VORTICES

ABA: R.J.F.

ABS: Advanced rotorcraft technology and tilt rotor aircraft were discussed. Rotorcraft performance, acoustics, and vibrations were discussed, as was the use of composite materials in rotorcraft structures. Rotorcraft aerodynamics, specifically the aerodynamic phenomena of a rotating and the aerodynamics of fuselages, was discussed.

82N23243*# ISSUE 14 PAGE 1903 CATEGORY 5 RPT#: NASA-TM-84705 NAS 1.15:84705 80/00/00 37 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshop. Volume 7: Tilt Rotor Session

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A03/MF A01
Workshop held at Palo Alto, Calif., 2-5 Dec. 1980

MAJS: /*AIRCRAFT CONTROL/*AIRCRAFT DESIGN/*AIRCRAFT PERFORMANCE/*GUST LOADS/*TILT ROTOR RESEARCH AIRCRAFT PROGRAM/*XV-15 AIRCRAFT

MINS: / AIR TRAFFIC CONTROL/ AIRCRAFT CARRIERS/ AIRCRAFT NOISE/ CIVIL AVIATION/ RESCUE OPERATIONS/ STRUCTURAL DESIGN CRITERIA

ABA: S.L.

ABS: The technical characteristics of the XV-15 aircraft were discussed. Program objectives, concept evaluation, tilt rotor experiments and civil market applications are presented. The XV-15 status and test schedule are also included.

82N23242*# ISSUE 14 PAGE 1903 CATEGORY 5 RPT#: NASA-TM-84180 NAS 1.15:84180 80/00/00 256 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshop. Volume 6: Vehicle Configuration Session

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC A12/MF A01
Workshop held at Palo Alto, Calif., 2-5 Dec. 1980

MAJS: /*AIRCRAFT CONFIGURATIONS/*AIRCRAFT SAFETY/*HELICOPTER DESIGN/*HIGH SPEED/*ROTARY WING AIRCRAFT/*ROTARY WINGS

MINS: / AERODYNAMIC CONFIGURATIONS/ AIRCRAFT NOISE/ AIRCRAFT RELIABILITY/ DRAG/ FUEL CONSUMPTION/ HELICOPTER CONTROL

ABA: S.L.

ABS: Five high speed rotorcraft configurations are considered: the high speed helicopter, compound helicopter, ABC, tilt rotor and the X wing. The technology requirements and the recommended actions are discussed.

82N23241*# ISSUE 14 PAGE 1903 CATEGORY 5 RPT#: NASA-TM-84207 NAS 1.15:84207 80/00/00 211 PAGES UNCLASSIFIED DOCUMENT

UTTL: NASA/HAA Advanced Rotorcraft Technology and Tilt Rotor Workshop. Volume 5: Propulsion Session

CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A10/MF A01
Workshop held at Palo Alto, Calif., 3-5 Dec. 1980

MAJS: /*HELICOPTER DESIGN/*HELICOPTER ENGINES/*PROPULSION SYSTEM PERFORMANCE
MINS: / AIRCRAFT STRUCTURES/ AIRFRAME MATERIALS/ COMBUSTION CHAMBERS/ COMPRESSORS/ HELICOPTER PERFORMANCE/ TURBINE ENGINES/ USER REQUIREMENTS
ABA: Author
ABS: The expressed needs and priorities of the civil helicopter users, the existing research efforts, and technology requirements as perceived by leading airframe and engine manufacturers were addressed, compared, and evaluated. Specifically, the observations and conclusions of these areas as they relate to the helicopter propulsion system are reported.

80N21283*# ISSUE 12 PAGE 1514 CATEGORY 2 RPT#: NASA-CP-2046 L-12232 79/00/00 262 PAGES UNCLASSIFIED DOCUMENT
UTTL: Advanced technology airfoil research, volume 2 --- conferences
CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A12/MF A01
Presented at conf., Langley Research Center, Hampton, Va. 7-9 Mar. 1978
MAJS: /*AIRFOILS/*CONFERENCES/*TECHNOLOGY ASSESSMENT/*TECHNOLOGY UTILIZATION
MINS: / AERODYNAMIC CHARACTERISTICS/ COMPUTER AIDED DESIGN/ GENERAL AVIATION AIRCRAFT/ ROTARY WING AIRCRAFT/ STRUCTURAL DESIGN/ SYSTEMS ENGINEERING/ TEST FACILITIES
ABA: R.E.S.
ABS: A comprehensive review of airfoil research is presented. The major thrust of the research is in three areas: development of computational aerodynamic codes for airfoil analysis and design, development of experimental facilities and test techniques, and all types of airfoil applications.

80N15127*# ISSUE 6 PAGE 781 CATEGORY 7 RPT#: NASA-CP-2077 E-9906 79/00/00 426 PAGES UNCLASSIFIED DOCUMENT
UTTL: Quiet powered-lift propulsion
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A19/MF A01
Conf. held at Cleveland, Ohio, 14-15 Nov. 1978
MAJS: /*C-15 AIRCRAFT/*CONFERENCES/*NASA PROGRAMS/*POWERED LIFT AIRCRAFT/*QUIET ENGINE PROGRAM/*TILT ROTOR AIRCRAFT/*YC-14 AIRCRAFT
MINS: / ARMED FORCES (UNITED STATES)/ PROPULSION SYSTEM PERFORMANCE/ RESEARCH AIRCRAFT/ TECHNOLOGY ASSESSMENT
ABA: R.E.S.
ABS: Latest results of programs exploring new propulsion technology for powered-lift aircraft systems are presented. Topics discussed include results from the 'quiet clean short-haul experimental engine' program and progress reports on the 'quiet short-haul research aircraft' and 'tilt-rotor research aircraft' programs. In addition to these NASA programs, the Air Force AMST YC 14 and YC 15 programs were reviewed.

79N23912*# ISSUE 15 PAGE 1926 CATEGORY 2 RPT#: NASA-CP-2086 FAA-RD-78-109 E-027 79/00/00 147 PAGES UNCLASSIFIED DOCUMENT
UTTL: Aircraft icing
AUTH: A/BLAHA, B. J. PAT: A/comp.
CORP: National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. AVAIL.NTIS SAP: HC A07/MF A01
Workshop held at Cleveland, 19-21 Jul. 1978
MAJS: /*AIRCRAFT HAZARDS/*CONFERENCES/*ICE FORMATION
MINS: / HELICOPTERS/ METEOROLOGY/ SAFETY MANAGEMENT
ANN: The results of a conference on the problems of aircraft icing are reported. For individual titles, see N79-23913 through N79-23919.

79N24951*# ISSUE 16 PAGE 2069 CATEGORY 1 RPT#: NASA-TM-80541 78/10/15 189 PAGES UNCLASSIFIED DOCUMENT
UTTL: Advanced rotorcraft technology: Task force report
CORP: National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC A09/MF A01
MAJS: /*AEROACOUSTICS/*AERODYNAMIC CHARACTERISTICS/*AIRCRAFT STRUCTURES/*HELICOPTER DESIGN/*ROTARY WING AIRCRAFT
MINS: / AIRFRAMES/ AVIONICS/ CIVIL AVIATION/ FLIGHT CONTROL/ MILITARY HELICOPTERS/ PROPULSION SYSTEM PERFORMANCE/ ROTOR AERODYNAMICS
ABA: A.R.H.
ABS: The technological needs and opportunities related to future civil and military rotorcraft were determined and a program plan for NASA research which was responsive to the needs and opportunities was prepared. In general, the program plan places the primary emphasis on design methodology where the development and verification of analytical methods is built upon a sound data base. The four advanced rotorcraft technology elements identified are aerodynamics and structures, flight control and avionic systems, propulsion, and vehicle configurations. Estimates of the total funding levels that would be required to support the proposed program plan are included.

79N10843*# ISSUE 1 PAGE 112 CATEGORY 71 RPT#: NASA-CP-2052-PT-2 L-12339-PT-2 78/08/00 438 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter Acoustics, part 2 --- conferences

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A19/MF A01

Presented at the Intern. Specialists Symp., Hampton, Va., 22-24 May 1978; sponsored by the Am. Helicopter Soc. and AROD

MAJS: /*AEROACOUSTICS/*AIRCRAFT NOISE/*CONFERENCES/*HELICOPTERS

MINS: / AUDITORY FATIGUE/ HUMAN FACTORS ENGINEERING/ NOISE REDUCTION/ PREDICTION ANALYSIS TECHNIQUES/ ROTARY WINGS/ ROTOR AERODYNAMICS

ANN: Exterior and interior helicopter noise problems are addressed from the physics and engineering as well as the human factors point of view. Noise regulation concepts, human factors and criteria, rotor noise generation and control, design, operations and testing for noise control, helicopter noise prediction, and research tools and measurements are covered. For individual titles, see N79-10844 through N79-10864.

78N32816*# ISSUE 23 PAGE 3136 CATEGORY 71 RPT#: NASA-CP-2052-PT-1 L-12339 78/08/00 399 PAGES UNCLASSIFIED DOCUMENT

UTTL: Helicopter Acoustics

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A17/MF A01

Presented at the Intern. Specialists Symp., Hampton, Va., 22-24 May 1978; sponsored by the Am. Helicopter Soc. and AROD

MAJS: /*AEROACOUSTICS/*AIRCRAFT NOISE/*CONFERENCES/*HELICOPTERS

MINS: / AIR TRANSPORTATION/ AIRFOIL PROFILES/ HELIPORTS/ NOISE POLLUTION/ NOISE REDUCTION/ POLLUTION CONTROL/ PREDICTION ANALYSIS TECHNIQUES/ REGULATIONS/ ROTARY WINGS/ ROTOR AERODYNAMICS/ URBAN DEVELOPMENT/ WIND TUNNEL TESTS

ANN: Exterior and interior noise problems are addressed both from the physics and engineering as well as the human factors point of view. The role of technology in closing the gap between what the customers and regulating agencies would like to have and what is available is explored. Noise regulation concepts, design, operations and testing for noise control, helicopter noise prediction, and research tools and measurements are among the topics covered. For individual titles, see N78-32817 through N78-32835.

78N19126# ISSUE 10 PAGE 1258 CATEGORY 5 RPT#: AGARD-CP-233 ISBN-92-835-1272-3 AD-A051589 78/01/00 342 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotorcraft Design

CORP: Advisory Group for Aerospace Research and Development. Paris (France). AVAIL.NTIS SAP: HC A15/MF A01

Proceedings of the Flight Mechanics Panel Symp., Moffett Field, Calif., 16-19 May 1977

MAJS: /*CONFERENCES/*HELICOPTER DESIGN/*HELICOPTER PERFORMANCE/*ROTARY WING AIRCRAFT

MINS: / ARMED FORCES (FOREIGN)/ ARMED FORCES (UNITED STATES)/ CIVIL AVIATION/ MILITARY HELICOPTERS/ TECHNOLOGICAL FORECASTING

ANN: Military and civilian rotorcraft designers are provided with exchanges concerning common problems and grounds for civil/military cooperation. Sessions included military requirements and new rotorcraft systems; civil operations and new helicopter designs; and research vehicles. Rotor wind tunnel and flight research are also reviewed, and opportunities for coordinating military and civil requirements and specifications are discussed. For individual titles, see N78-19127 through N78-19151.

79A10903* ISSUE 1 PAGE 13 CATEGORY 5 78/00/00 211 PAGES UNCLASSIFIED DOCUMENT

UTTL: Conference on Helicopter Structures Technology, Moffett Field, Calif., November 16-18, 1977. Proceedings SAP: $10.00

Conference sponsored by the American Helicopter Society and NASA. Moffett Field, Calif., U.S. Army Air Mobility Research and Development Laboratory, 1978. 211 p (For individual items see A79-10904 to A79-10921)

MAJS: /*AIRCRAFT STRUCTURES/*CONFERENCES/*HELICOPTER DESIGN/*STRUCTURAL DESIGN

MINS: / AIRCRAFT MANEUVERS/ BEARINGLESS ROTORS/ COMPOSITE STRUCTURES/ COMPUTERIZED SIMULATION/ DYNAMIC MODELS/ FAIL-SAFE SYSTEMS/ FINITE ELEMENT METHOD/ LANDING GEAR/ ROTARY WINGS/ ROTOR BLADES/ STRUCTURAL RELIABILITY/ STRUCTURAL WEIGHT/ ULTRASONIC WELDING

ABA: P.T.H.

ABS: Work on advanced concepts for helicopter designs is reported. Emphasis is on use of advanced composites, damage-tolerant design, and load calculations. Topics covered include structural design flight maneuver loads using PDP-10 flight dynamics model, use of 3-D finite element analysis in design of helicopter mechanical components, damage-tolerant design of the YUH-61A main rotor system, survivability of helicopters to rotor blade ballistic damage, development of a multitubular spar composite main rotor blade, and a bearingless main rotor structural

design approach using advanced composites.

77N21022*# ISSUE 12 PAGE 1535 CATEGORY 1 RPT#: NASA-SP-415 76/00/00 483 PAGES UNCLASSIFIED DOCUMENT

UTTL: Flutter Testing Techniques

CORP: National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. AVAIL.NTIS SAP: HC A21/MF A01

Conf. Proc. held at Dryden Flight Res. Center in Edwards, Calif., 9-10 Oct. 1975

MAJS: /*AERODYNAMIC NOISE/*AEROELASTICITY/*CONFERENCES/* FLUTTER ANALYSIS/*REAL TIME OPERATION

MINS: / MODAL RESPONSE/ PREDICTION ANALYSIS TECHNIQUES/ RANDOM VIBRATION/ ROTARY WING AIRCRAFT/ WIND TUNNEL TESTS

ANN: Developments in methodology and data analysis techniques for flutter testing in flight and on the ground are discussed.

74N20756# ISSUE 12 PAGE 1385 CATEGORY 5 RPT#: AGARD-CP-134 74/02/00 121 PAGES UNCLASSIFIED DOCUMENT

UTTL: Escape problems and maneuvres in combat aircraft --- conference on aircraft escape systems for helicopters and V/STOL aircraft

AUTH: A/JONES, W. L. PAA: A/(NASA, Washington, D. C.)

PAT: A/ed.

CORP: Advisory Group for Aerospace Research and Development, Paris (France).; National Aeronautics and Space Administration, Washington, D. C. AVAIL.NTIS SAP: HC $9.25

Papers Presented at Aerospace Med. Panel Specialists, Soesterberg, Netherlands, 4 Sep. 1973

MAJS: /*AIRCRAFT EQUIPMENT/*CONFERENCES/*EJECTION SEATS/* ESCAPE SYSTEMS

MINS: / HUMAN FACTORS ENGINEERING/ HUMAN TOLERANCES/ LIFE SUPPORT SYSTEMS/ SAFETY DEVICES

ANN: The proceedings of a conference on the subject of problems of escape from rotary wing and V/STOL aircraft are presented. The purpose of the meeting was to delineate the important aspects of the escape problems and to review new concepts in escape technology. The subjects covered was broad ranging from biomedical issues in air combat mishaps in high performance aircraft to human factors and engineering aspects of inflight escape in all types of aircraft.

74A37481* ISSUE 18 PAGE 2538 CATEGORY 2 74/00/00 386 PAGES UNCLASSIFIED DOCUMENT

UTTL: Specialists Meeting on Rotorcraft Dynamics, Moffett Field, Calif., February 13-15, 1974. Proceedings Meeting sponsored by the American Helicopter Society and NASA, Moffett Field, Calif., NASA Ames Research Center, 1974. 386 p.

MAJS: /*CONFERENCES/*HELICOPTER DESIGN/*ROTOR AERODYNAMICS/* ROTORCRAFT AIRCRAFT

MINS: / AERODYNAMIC STALLING/ AEROELASTICITY/ AIRFRAMES/ COMPLEX SYSTEMS/ FINITE ELEMENT METHOD/ FLAPPING/ FORCED VIBRATION/ FREE VIBRATION/ ROTOR BLADES/ TORSIONAL VIBRATION

ABA: J.K.K.

ABS: Analysis of specific problems in rotorcraft dynamics. Topics include hingeless rotor theory, dynamic stall modelling, periodic systems identification, analysis of complex systems with phasing matrices, flapping stability, flap-lag dynamics at high advance ratios, finite element analysis and fuselage free-vibration characteristics, coupled rotor/frame vibration methods, gust response characteristics with unsteady stall effects, antiresonance theory, cyclic feathering motions and dynamic loads, control load envelope shaping, rotor aeroelasticity, use of Floquet theory, theory of proprotors and tilt-rotors, two-bladed teetering rotors, stability of air and ground resonance, vertical-plane pendulum absorbers, multicyclic jet-flap control, engine/frame interface dynamics, and others. The minutes of the question and answer periods following the presentations are presented in the supplement. Individual items are announced in this issue.

74N34480*# ISSUE 24 PAGE 2901 CATEGORY 2 RPT#: NASA-SP-352 74/00/00 370 PAGES UNCLASSIFIED DOCUMENT

UTTL: Rotorcraft dynamics

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. AVAIL.NTIS SAP: HC $8.00

Washington Conf. held at Moffett Field Calif., 13-15 Feb. 1974; Sponsored in part by the American Helicopter Soc.

MAJS: /*CONFERENCES/*ROTOR AERODYNAMICS/*ROTORCRAFT AIRCRAFT

MINS: / DYNAMIC STRUCTURAL ANALYSIS/ HELICOPTERS/ LOADS (FORCES)/ ROTARY WINGS/ VIBRATION

ANN: The dynamic structural analysis of rotary winged aircraft is reported, considering helicopter vibration and loads.